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Supreme Court of the United States

MINERALS SEPARATION LIMITED and MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED,
Petitioners and Complainants,
against
JAMES M. HYDE,
Respondent and Defendant.

PETITION FOR WRIT OF CERTIORARI TO BE ADDRESSED TO THE JUDGES OF THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT.

To the Honorable

THE CHIEF JUSTICE AND ASSOCIATE JUSTICES OF THE SUPREME COURT OF THE UNITED STATES.

Your petitioners, Minerals Separation, Limited and Minerals Separation American Syndicate, Limited, respectfully show:

Your petitioners are respectively the owner of and general licensee under United States letters patent No. 835,120 to Sulman, Picard and Ballot of November 6, 1906, for a process of ore concentration. The defendant James M. Hyde was a former employe of your petitioners and by them trained in the process of the patent in suit. The suit is for

infringement of this patent and was brought in the United States District Court of Montana. The decree of that Court adjudged the validity of the patent and infringement thereof and granted an injunction against the defendant (Rec., pp. 47-49). The opinion was by Judge Bourquin (Rec., pp. 33-46). The decree was interlocutory in that it directed an accounting of profits and damages, but an appeal was properly taken to the Circuit Court of Appeals of the Ninth Circuit, with the result that the decree of the District Court was reversed and the dismissal of the Bill ordered (Rec., 1291, 1292). The ground for this reversal was that the patent was void for the reason that the invention, although new and useful, involved "a difference of degree and not of kind" (Rec., p. 1283).

The process of the patent in suit is known as the agitation froth process. Essentially it consists in the violent agitation of a pulp of finely ground ore and water with a minute quantity of oil, resulting in the production of a mineral froth which floats upon the surface of the liquid, carrying with it the valuable metal contained in the ore, while the gangue or rock particles remain in the liquid. A small quantity of acid or moderate heat or both are sometimes additionally employed.

The invention originated in England and was first patented there, the British patent corresponding to the patent in suit being No. 7803 of 1905 (Rec., pp. 470, 471). The British application was filed April 12, 1905, and under the provisions of the International Convention for the protection of industrial property the application for the patent in suit was filed in the United States Patent Office May 29, 1905. Applications for patents for the same invention were also filed in some twenty-five

countries in different parts of the world in addition to the United States and Great Britain (Rec., p. 443).

The moderate use of the invention in Great Britain and its very extensive use in Australia were attacked upon the ground of infringement of prior patents to Elmore for an oil buoyancy process of ore concentration, resulting in two litigations, one terminating in the British House of Lords in 1909, and the other in the Privy Council of the British Empire (Lord Chancellor Haldane presiding) in 1914, wherein it was adjudged that your petitioners' agitation froth process was essentially different from the Elmore process and did not infringe the Elmore patents, and wherein several prior patents and a prior publication relied upon by the Circuit Court of Appeals for the Ninth Circuit as anticipations of the patent in suit received the most careful consideration, as will hereinafter appear.

The reasons especially urged for the granting of this petition, and which will be elaborated below, are summarized as follows:

1st. The decision of the United States Circuit Court of Appeals reversing the judgment of the United States District Court is at variance with judgments theretofore rendered by the Privy Council of the British Empire and by the British House of Lords respecting the same invention.

2nd. The decision of the United States Circuit Court of Appeals is in conflict with the decision of this Court upon a question of law, namely, the effect of alleged anticipatory inventions where the prior patents have not been successful and have not gone into public use, and the later patent attacked has been successful and widely used.

3rd. There is a conflict of adjudication among different Circuits on a question of law necessarily involved, namely, the effect of alleged anticipation by an invention patented subsequent to the origin of the invention in issue, but upon an application for patent actually on file but maintained in secrecy in the Patent Office at the time of the invention in issue.

4th. The rights of British corporations as patentees in the United States are involved and to that extent questions of international importance arise.

5th. The questions involved are of gravity and importance.

I. THE DECISION OF THE UNITED STATES CIRCUIT COURT OF APPEALS OF THE NINTH CIRCUIT, WHILE ADMITTING THE NOVELTY AND UTILITY OF THE PROCESS IN ISSUE, IS AT VARIANCE WITH THE JUDGMENTS OF THE PRIVY COUNCIL OF THE BRITISH EMPIRE AND OF THE BRITISH HOUSE OF LORDS RELATIVE TO THE SAME PROCESS AS TO THE CHARACTER AND EFFECT OF THE ADMITTED NOVELTY OF THAT PROCESS.

Final judgments, one of the Privy Council and another of the House of Lords, in complete harmony with each other and expressing the views f ten Law Lords of England, viz.: of the Lord Chancellor, Viscount Haldane, of former Lord Chancellors Lord Loreburn and the Earl of Halsbury, and of Lords Ashbourne, Atkinson, Shaw, Dunedin, Parker, Sumner and Parmoor, are in direct conflict with the decision of the Circuit Court of Appeals of the Ninth Circuit written by Judge Gilbert and concurred in by Judges Ross and Dietrich, both as to matters of law and fact having material bearing upon the patentability of the process in suit. The District Court of Mon-

tana (Judge Bourquin) in harmony with the highest British courts held the patent valid, while the Circuit Court of Appeals of the Ninth Circuit has held it to be invalid.

The Privy Council judgment (*Ore Concentraton Co.* [*1905*] *Ltd.* v. *Sulphide Corporation, Ltd.*, 31 R. P. C., 206, March 6, 1914) is printed in full in the Transcript of Record herein (Rec., pp. 1343-1362). In that case the plaintiffs-appellants, The Ore Concentration Company (1905) Limited and another were the owners of a New South Wales (Australian) patent known as the Elmore patent. The defendant-respondent, The Sulphide Corporation, Limited, was a licensee of Minerals Separation, Limited, one of the petitioners herein. The process of concentrating ores used by the defendant and charged to be an infringement of the Elmore patent was the identical agitation froth process forming the subject matter of the patent in suit herein, No. 835,120, to Sulman, Picard and Ballot, of November 6, 1906. The Privy Council judgment refers (Rec., p. 1345) to the prior judgment of the British House of Lords, in *British Ore Concentration Syndicate* v. *Minerals Separation Limited*, 27 R. P. C. 33 (Printed in Appendix hereto). The defendant-appellant in that suit, Minerals Separation Limited, is one of the petitioners-complainants here, and the defendant's process there charged to be an infringement is the process forming the subject matter of the patent in suit here, the British patent No. 7803 of 1905, corresponding with the patent in suit here, being referred to and quoted by Lord Shaw (*infra*, pp. 57-59) as describing the defendant's process. The Privy Council judgment was rendered upon a case different in three specified particulars (Rec., p. 1345) from the case in

the House of Lords, but these differences did not relate to the acts of defendant charged as the infringement.

In the decision of the Circuit Court of Appeals of the Ninth Circuit it is said:

> "When the claims and the description of the appellees' patent are compared with the patents of the prior art, it will be seen that *the only material difference is in the smaller quantity of oil which the appellees use*" (Rec., p. 1281. Italics ours).

And further

> "*To discover that the desired result may be accomplished with the use of a fraction of one per cent. of oil* when formerly a much larger quantity of oil had been used, and had been deemed necessary, is not an invention or discovery within the meaning of the patent laws. It is a difference of degree and not of kind" (Rec., pp. 1282, 1283. Italics ours).

And further

> "We hold that to sustain the appellees' patent would be to give to the owners thereof a monopoly of that which others had discovered. What they claim to be the new and useful feature of their invention, as stated by their counsel, is 'agitating the mixture to cause the oily coated mineral to form a froth.' As we have seen, that feature was clearly anticipated by the prior art, and when the elements of the appellees' claim are read one by one, it will be found that each step in their process is fully described in more than one of the patents of the prior art, *with the single exception of the reduced quantity of oil which they use. The patentees of the appellees' patent made a valuable contribution to the art* in discovering the smallest quantity of oil which would produce the desired result. * * * *Their discovery* that a small fraction of one per cent. of oil is sufficient to produce flotation of the metalliferous matter cannot as we have seen, be made by itself or in a combination the sub-

ject of a patent. The appellees cannot take from others the right to use oil economically" (Rec., pp. 1289, 1290. Italics ours).

In contrast in the Privy Council judgment it is said of the respondents' process there (the process of the patent in suit here):

> "The real difficulty which their Lordships have to determine is whether the Respondents in the process of separation which they employ, entrap or coat and hold or carry the metallic particles in oil, using oil as the selective agent. The Respondents deny that they in any way use the Appellants' invention, and say that their process is essentially distinct, and that its successful operation depends on the law of surface tension. It is not incumbent on the Respondents to explain the law on which the success of their process depends" (Rec., p. 1358).
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> * * * * * *
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> "Apart from any question of theory, the Respondents use oil in their process under conditions which make it almost impossible to entrap or coat and hold the metallic particles by the selective agency of oil. The respondents use a thin oil at a temperature of 120° Fahr., the quantity is minute, not more than 2 or 3 pounds to a ton of ore, or about 2 or 3 pints of oil to 10,000 pints of water; the resulting concentrate is practically free from oil and no mechanical contrivance to separate the oil from the metallic particles is required or used; the residue of the first concentration is further treated without any further addition of oil" * * * "their Lordships accept the evidence of Professor Pollock (defendant's expert) * * * summarized as follows: Professor Pollock is referred to his earlier evidence, and states that he does not think that the small quantity of oil introduced in the Defendants' process necessarily performs any other function than permanency in the froth and extremely minute emulsion. He allows that there may be oil in excess, and that some of the particles may get oiled, but states that this is entirely and absolutely unessential. He

> does not however think that more than the necessary quantity of oil is introduced to effect concentration, but that having regard to the nature of the problem it is a matter of conjecture and exact calculation is not possible. Finally he reiterates his opinion that the Defendants' process can be accounted for without assuming selection of the metallic particles by oil" (Rec., pp. 1359, 1360).

In the House of Lords judgment, the Earl of Halsbury, considering the Elmore patent there in suit and the prior Everson patent hereinafter referred to, and contrasting them with the defendant's process (the process of the patent in suit here) said:

> "My Lords, I am of opinion that the two inventions are essentially different. I mean by the two inventions those which might be technically described, the one upon the selective action of oil the other upon surface tension. That the two processes are in these respects totally different cannot be denied, and the acidulation which is supposed to incriminate the latter process with infringement is common to the first process and to another (Everson) which was invented and patented before it" (*infra* p. 46).

In other words, the agitation froth process depends upon the surface tension, the physical law controlling the production of the agitation froth, and the Everson and Elmore patents depend upon the selective action of oil.

Again Lord Shaw said of the defendant's process there (the process of the patent in suit here):

> "they are not promoting a method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of

> air cells, the buoyancy of which air cells, forming round single particles of the metal floats them to the surface of the liquid" (*infra*, p. 59).

Lord Shaw then gives consideration to the defendants' process as described in the British patent corresponding to the patent in suit here, and then as to the question of infringement by that process of the Elmore patent says:

> "nor do I see my way to hold that there has been any contravention of the 1901 (Elmore) patent by the application of the acid to a mixture in which the oil has been reduced from bulk to the merest fraction, and especially when froth instead of oil has been secured, along with the law of capillarity or surface tension, as the main floating and separating agent" (*infra*, p. 60).

Again in the House of Lords decision Lord Atkinson says of the process of the defendant there (the process of the patent in suit here):

> "in their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found, not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles which, introduced into the mixture by the more or less violent agitation of it, envelope or become attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water" (*infra*, p. 51).

The House of Lords had before it the British patent corresponding to the patent in suit and evidence of the use of the process described therein. The Privy Council had before it evidence of the very extensive use of that process in Australia. Their views as to the essential characteristics of that process were reached after the most careful

and exhaustive consideration, and as will be seen their conclusions are irreconcilable with the opinion of the Circuit Court of Appeals of the Ninth Circuit as to the same process.

As to the prior art, there is a marked divergence of opinion between the three Judges of the Circuit Court of Appeals of the Ninth Circuit on the one hand, and the ten Law Lords of England who participated in the two judgments above referred to, on the other hand. The Circuit Court of Appeals, after reviewing the patents of the prior art, including the Haynes British patent No. 488 of 1860 and the Everson United States patent No. 348,157 of 1886 (Rec., p. 1277), held:

> "The froths are all similar in appearance, they all rise to the surface after the same amount of agitation, they all gather with equal efficiency the same quantity of metal, and all may be removed from the surface in the same way" (Rec., p. 1285).

In the House of Lords judgment this Everson patent is repeatedly referred to (the Lord Chancellor, Lord Loreburn, *infra,* p. 45; Lord Atkinson, *infra,* p. 51; Lord Shaw, *infra,* p. 51; and by the Earl of Halsbury, in the quotation above given and the reference to the dilemma put by Mr. Justice Neville, *infra,* p. 48, see Justice Neville's judgment, High Court of Justice, 25 R. P. C. 741, 756), yet Lord Shaw says that the process of the defendant there (of the patent in suit here) is

> "a new method of separation" (*infra,* p. 59),

and then repeatedly quotes, from the Sulman, Picard and Ballot British patent corresponding to the patent in suit here, language exactly repeated in the patent in suit here, evidencing the fact that the production of a mineral froth by agitation is

the dominant characteristic of this process and was new.

In the Privy Council the full text of the Everson specification was not available, only the claims having been published in Australia. This is stated to be the second point of difference between the House of Lords case and the Privy Council case (Rec., p. 1345). The disclosure of these claims is commented upon (Rec., p. 1347), but it is said that they may be disregarded (Rec., p. 1350). On the other hand the Criley and Everson publication in the Engineering & Mining Journal of November 15, 1890, referred to in the decision of the Circuit Court of Appeals of the Ninth Circuit (Rec., pp. 1285-1286), which had not been pleaded in the House of Lords case against the particular Elmore patent finally considered, was carefully considered in the Privy Council case (Rec., p. 1350) and its omission from the House of Lords case stated to be the third point of difference between that case and the Privy Council case (Rec., p. 1345). Of this publication it is said in the Privy Council judgment:

> "the only information given is that if to a greased mixture of pulverized metal and rock you add boiling sulphuric acid in a sufficient quantity of water in some way a differentiation is effected as between the metal and the gangue" (Rec. p. 1350).

In contradistinction to this finding of the Privy Council, the Circuit Court of Appeals of the Ninth Circuit expressly includes this publication as disclosing the production of a mineral froth by agitation, and says the froth in all these processes is the same except as to the quantity of oil therein, the agitation is the same, and the efficiency is the same, as that produced by the agitation froth process of the patent in suit (Rec., pp. 1284, 1285).

Again the Haynes British patent of 1860, also expressly included by the Ninth Circuit Court of Appeals in the prior art processes said to disclose a similarly efficient agitation froth (Rec., pp. 1284, 1285), is commented upon in the Privy Council case as follows:

> "This document is not more than an indication of the date at which attention was first directed to the affinity of oils for metals" (Rec., p. 1347).

The divergence of opinion between the British courts and the Circuit Court of Appeals of the Ninth Circuit is only partially a difference as to the facts, since the manner of interpretation of prior patents and disclosures is a matter of law. The divergence arises largely from the failure of the Ninth Circuit Court of Appeals to apply the proper rules of law in considering the incomplete and indefinite disclosures of these prior patents and publication.

The chronological order of the judgments and decisions in British and American courts as to petitioners' agitation froth process is as follows:

1. November 16, 1909. Judgment of House of Lords (the Lord Chancellor, Lord Loreburn; the Earl of Halsbury, Lords Ashbourne, Atkinson and Shaw) holding that it is a new method of separation, the novelty consisting in the production of a mineral froth by agitation.

2. July 28, 1913. Decision of Judge Bourquin of the United States District Court of Montana, in the present suit (Rec., pp. 33-46) in harmony with the House of Lords judgment, holding that it is new, useful and patentable.

3. March 6, 1914. Judgment of Privy Council of British Empire (the Lord Chancellor, Viscount Haldane; Lords Dunedin, Parker, Sumner and

Parmoor), in harmony with the House of Lords judgment, asserting its novelty and characterizing as indefinite and ineffective two of the identical prior art disclosures relied upon by the Circuit Court of Appeals of the Ninth Circuit as anticipative.

4. May 4, 1914. Decision of the Circuit Court of Appeals of the Ninth Circuit, in agreement with Judge Bourquin's decision as to novelty and utility, but reversing him as to patentability, and in conflict with all of the prior judgments as to the essential character and results of the admitted novelty of petitioners' agitation froth process.

As the Privy Council judgment was rendered after the argument in the Circuit Court of Appeals (on February 19 and 20, 1914), it was called to the attention of the Judges of the Ninth Circuit in a Petition for Rehearing (Rec., pp. 1293-1342) and was annexed to that petition as additional authority, and is therefore included in the Transcript of Record filed in this Court (Rec., pp. 1343-1362). This petition was denied on July 6, 1914 (Rec., p. 1363).

II. THE PROCESS OF THE PATENT IN SUIT IS ONE OF WORLD WIDE USE, WHICH HAS RECOVERED, LARGELY FROM WASTE MATERIAL, GREAT TONNAGES OF VALUABLE METAL AT A PROFIT OF MANY MILLIONS OF DOLLARS.

Judge Bourquin, in his decision, says of all the prior disclosures relied upon for anticipation:

> "There is little evidence of practical use of any of these prior processes, and no substantial evidence that any substantial commercial success has accrued to any of them, or that any of them has had any considerable continuous successful operation. Some have operated commercially with some small success, and some are long since abandoned as

impracticable, experiments, failures" (Rec., p. 37).

And of the process of the patent in suit, Judge Bourquin says:

> "Complainants' process has, in substance displaced some of the prior, and has firmly established itself as a new and valuable method of ore reduction. The evidence shows many and large plants thereof, built or building, in widely separated parts of the world. Its successful operations, practically from discovery, have recovered, and largely from waste and tailings, values aggregating near $9,000.000 and at a profit of near $4,000,000 to the patent owner and its licensees" (Rec., pp. 37 38).

In the decision of the Circuit Court of Appeals of the Ninth Circuit it is said:

> "The decision of the Court below appears to have been largely influenced by the consideration that the appellees' patent had gone into extensive and successful use" (Rec., p. 1287).

And it is further said:

> "The appellees' process, originally patented in Great Britain, has been installed in Australia, Sweden, Finland, Chile and Wales, and is in process of installation in Cuba" (Rec., p. 1287).

It may be added that the record shows that all the widespread uses above referred to were under license from your petitioner, Minerals Separation, Limited, thereby involving recognition in these countries of the validity of patents of your petitioner, Minerals Separation, Limited, corresponding to the patent in suit here. It appears that the invention in issue has been patented in twenty-six countries in all, in Europe, Asia, Africa, Australia and the Americas (Rec., p. 776). As to the further enormous growth in the use of the

invention throughout the world generally and this country, in particular, since the testimony on this point was closed in London more than two years ago, there is no evidence in the record.

We have above set forth particulars wherein the decision of the Circuit Court of Appeals of the Ninth Circuit and the judgments of the British courts are in conflict. In the evidence in the present suit and in the decision of Judge Bourquin appealed from it very fully appears that the novelty of the agitation froth process is *novelty* in *kind* and *not* in *degree*. Judge Bourquin says:

> "The process in suit is so clearly new that no exhaustive discussion of facts, cases or law is necessary to distinguish it from other processes or to demonstrate its novelty. The patentees herein discovered a new, cheap, simple, practical and useful way or process to combine oil and air, and, by agitation, to float and secure the metallic contents in ore concentration" (Rec., p. 42).

It appears in the evidence and is in fact stated in the opinion of the Circuit Court of Appeals that Petitioners' inventors were the first to employ oil in the minute quantity specified in conjunction with vigorous agitation of the pulp, and the first to discover the remarkable result that followed.

It appears also in the evidence that this discovery was made in the course of a series of experiments in which the conditions, including the quantity of oil employed, were progressively varied.

The Circuit Court of Appeals held that while this discovery was a valuable contribution to the art, it was merely a discovery of the smallest quantity of oil which would produce an old result and that the patent was merely an attempted monopoly of the right to use oil economically in an old process.

It is, however, mathematically demonstrated in the evidence (and is not contradicted) that the separation and flotation of the valuable metal could not be accounted for on the *theory* or by the *mode of operation* of the prior oil flotation processes. The quantity of oil present was far below the quantity necessary for that sort of operation.

It appears too in the evidence (and is not contradicted) that when in the series of experiments referred to a certain point was reached in reduction of the quantity of oil—a point where the quantity of oil was already minute—the nature of the result began suddenly and quickly to change, and whereas reductions of the quantity of oil above that point produced progressively poorer results, continued reduction of the now minute quantity of oil below that point, produced a rapidly improving result, both unexpected and startling, accompanied by a wholly *novel* froth phenomenon, until the point specified in the patent was reached, when a maximum effect was produced (Rec., pp. 895-898; p. 356).

It appears also in the evidence that these phenomena, inexplicable as they were on the theory and mode of operation of the prior oil selection and flotation processes, demonstrated that a *new* principle and mode of operation had been introduced.

It also appears in the evidence that the new results were so superior to anything ever before produced by any process of the prior art that the new process succeeded where they had failed, and has been extensively introduced in commerce all over the world where they have not been.

The Circuit Court of Appeals held that the sole advantage of the discovery was in the saving of oil.

It appears in the record, however, that the benefit of the discovery was in the recovery of millions of dollars worth of precious and semi-precious metals from dumps and low grade ores, and from slimes formerly wasted, where such recovery had not been previously attempted because no practical process to that end was known.

It appears in the evidence that the prior oil processes had failed, not because of the price of oil, but because the wrong principle and mode of operation had been invoked, and because the discovery which petitioners' inventors have since made had not then been made—the discovery of the right principle and mode of operation and of the way to induce it and to utilize it.

It appears in the evidence, just as it appears in the judgments of the British courts, that the reduction of the quantity of oil to the minuteness specified in the patent, in conjunction with the vigorous action specified, induced a new and different principle and mode of operation, and produced a new and different result.

The following is quoted from the evidence of the eminent metallurgist and chemist, Dr. Charles F. Chandler:—

> "The process of the patent in suit is a new process, not disclosed in any or all of the documents referred to by complainants or defendants as prior documents. It was to me a most surprising process. After studying all these prior documents my surprise is not diminished that such a process is possible. There is nothing like it disclosed in the prior art and the failures of other inventors tended to discourage rather than encourage the hope that the economical concentration of ores was capable of realization in a process utilizing the affinity of oil for metallic substances" (Rec., Chandler, pp. 776, 777).

It further appears in the testimony of another eminent scientist, Dr. Adolf Liebmann, of London, that the process of the patent in suit "produces a result which was never obtained before" (Rec., p. 510), that it is "an entirely novel, ingenious and unexpected process" (Rec., p. 509), that the froth is of a "very peculiar character * * * consisting of air bubbles, which in their covering film have the minerals embedded in such manner that they form a complete surface all over the air bubbles," that though "the very light and easily destructible air bubbles are covered with a heavy mineral, yet the froth is stable and utterly different, so far as this property is concerned, from any froth known to me"; that "the froth has a long life * * * is permanent, at least as far as metallurgical operations are concerned," that "the difference between the previous processes and the process of the patent in suit, is the difference between failure and success," that "the simplicity of the operation as compared with the prior attempts is startling" (Rec., p. 510).

In both of the English cases the very question of law and fact at issue (and on which the question of infringement turned) was whether the novel procedure of petitioners' inventors, involving, as it did, the employment of a minute and almost infinitesimal quantity of oil in conjunction with vigorous agitation, introduced a substantially new mode of operation and produced a substantially new result when compared with the prior Elmore processes in which a relatively large and substantial quantity of oil was employed.

Similarly in the case before the Circuit Court of Appeals the very question at issue (on which the question of patentability necessarily turned) was whether the novel procedure of petitioners' inventors, involving, as it did, the employment of a min-

ute and nearly infinitesimal quantity of oil in conjunction with vigorous agitation, introduced a substantially new mode of operation and produced a substantially new result when compared with the [redacted] oil processes of the prior art, in all of which a relatively large and substantial quantity of oil was employed.

Thus the issue of patentability here and the issue of infringement in the British cases both turn upon the same identical issue of law and fact, and on that issue the decision of the Circuit Court of Appeals is directly contrary to both of the British judgments.

The Circuit Court of Appeals and your petitioners' home courts agree that a discovery and a valuable and important contribution to the practical art have been made, but they are at variance as to the principle and mode of operation involved in the novel procedure.

It is both because a valuable and important contribution has been made to the practical art, and because the variance as to its real nature has arisen between the Courts of Appeals of England and of this country, that the petitioners respectfully urge that they be accorded the judgment of this Court on that question.

III. THE DECISION OF THE UNITED STATES CIRCUIT COURT OF APPEALS OF THE NINTH CIRCUIT IS CONTRARY TO THE DECISIONS OF THIS COURT AS TO THE LEGAL EFFECT TO BE GIVEN TO THE FACT THAT THE INVENTION OF THE PATENT IN SUIT HAS BEEN SUCCESSFUL AND HAS GONE INTO LARGE PUBLIC USE WHILE THE ALLEGED ANTICIPATORY INVENTIONS OF

PRIOR PATENTS HAVE NOT BEEN SUCCESSFUL AND HAVE NOT GONE INTO PUBLIC USE.

Thus the Circuit Court of Appeals, speaking of one of the prior patents—the prior patent which Judge Bourquin characterized as the closest approximation in the art to the patent in suit—says:

> "but the appellees say that the Froment patent is a paper patent, and that therefore it is to be disregarded. A paper patent *if it fully describes an invention*, whether it be a machine, device or process, is just as effective to show anticipation as a patent which described an invention which has gone into extensive use, for a presumption of operativeness and of some utility attends the granting of letters patent" (Rec., p. 1282. Italics ours).

Numerous cases are then cited which undoubtedly are authority for the statement that a prior paper patent which fully describes an invention is an anticipation. But the Circuit Court of Appeals of the Ninth Circuit states *that none of the prior patents fully describes the invention,* that there is a "material difference" in the "smaller quantity of oil which the appellees' use." And again, they find as a matter of fact that every step of plaintiffs' process is disclosed "with the single exception of the reduced quantity of oil which they use." It was, therefore, an error of law for the Circuit Court of Appeals to apply to alleged anticipatory patents which do not in fact fully describe the invention in suit a principle of decision properly applicable only where the alleged anticipatory patent "fully describes" the invention in question.

It was further error of law for the Circuit Court of Appeals to disregard as immaterial on the question of patentability the fact that plaintiffs'

process was a success where prior processes failed, and went into large and extensive commercial use where they did not, the fact being admitted and found that the plaintiffs' process differed in some of its steps, to wit, in the matter of the minute quantity of oil employed in conjunction with the vigorous agitation employed, from any and every process of the prior art.

It appeared in the evidence and was found by Judge Bourquin, and the finding was not questioned by the Circuit Court of Appeals, that the prior processes failed where the process of the patent in suit has succeeded, and under the decisions of this Court that fact should have been considered by the Circuit Court of Appeals and given weight as tending to show that the departure the patentees made in their procedure from the processes disclosed in the prior art were not obvious but involved patentable invention.

It has been uniformly held by this Court that where an invention has been successful and has gone into large public use and where the alleged anticipatory inventions of prior patents have not been successful and have not gone into public use, that a presumption of patentability arises, and that where there is a material difference, as has been held to exist by the Circuit Court of Appeals in the present case, that difference being the step from failure to success, the invention is patentable.

Barbed Wire Patent, 143 U. S., 275, 282, 283.

Diamond Rubber Tire Co. v. *Consolidated Rubber Tire Co.,* 220 U. S., 428, 435.

Carnegie Steel Co. v. *Cambria Iron Co.,* 185 U. S., 403.

IV. THIS SUIT INVOLVES THE QUESTION OF ANTICIPATION BY AN INVENTION PATENTED SUBSEQUENT TO THE ORIGIN OF THE INVENTION IN ISSUE ON AN APPLICATION FOR A PATENT ACTUALLY ON FILE BUT MAINTAINED IN SECRECY IN THE PATENT OFFICE AT THE TIME OF THE INVENTION IN ISSUE. THERE IS A CONFLICT OF ADJUDICATION AMONG THE DIFFERENT CIRCUITS AS TO THIS QUESTION.

The two later patents held by the Circuit Court of Appeals of the Ninth Circuit to be anticipative, are the patent to Schwarz, a domestic inventor, granted December, 1905, and the patent to Kirby, a resident of Canada, granted January, 1906. The application for the patent in suit was filed in the United States Patent Office on May 29, 1905.

The Circuit Court of Appeals of the Ninth Circuit includes these two patents in the patents "which are adverted to as showing the prior art" (Rec., p. 1277) introducing these particular patents as follows:

> "The Schwarz United States patent No. 807,503, applied for in May, 1904, and granted in December, 1905" (Rec., p. 1278).
>
> "The United States patent to Kirby, No. 809,959, was applied for December 14, 1903, and granted January 16, 1906" (Rec., p. 1278).

Thereafter these patents are treated as prior art and are held to anticipate the invention of the patent in suit in disclosing the production of a similarly efficient mineral froth, but by the employment of greater quantities of oil, the Court holding that it did not involve invention to reduce the quantity of oil to a minute proportion—"a small fraction of one per cent." (Rec., p. 1290).

To thus treat later patents is in conflict with the decision of this Court in *Bates* v. *Coe*, 98 U. S., 31, and with the decisions in the Circuit Court of Appeals of the Second Circuit, an example of which is *Vacuum Engineering Co.* v. *Dunn*, 209 Fed., 219. It is however consistent with decisions of the Circuit Court of Appeals of the Sixth Circuit, such as *Drewson* v. *Hartje Paper Mfg. Co.*, 131 Fed. 734 and *Electric Controller Co.* v. *Westinghouse Mfg. Co.*, 171 Fed., 83. *The conflict of adjudication between the Circuit Courts of Appeals of the Ninth Circuit in the present suit and the Sixth Circuit in the cases referred to, on the one hand, and the Second Circuit, as for example in the case referred to, on the other hand, is squarely presented in the present suit.* It is true that at the argument in the Ninth Circuit Court of Appeals your petitioners did not raise this question, but referred to the conflict of authorities and asked an adjudication on the difference in subject matter between the disclosures of these patents and the invention in issue. There was no waiver of the right of your petitioners to raise that question in this Court, and the Circuit Court of Appeals evidently decided the question as one which it had a right to decide in harmony with the above decisions of the Circuit Court of Appeals of the Sixth Circuit, which were cited in defendant-appellants brief on this question. The question is one of great importance in the adjudication of the patent laws, and an authoritative finding by this Court would prevent much future uncertainty and conflict among the circuit courts of appeal.

Your petitioners are advised and believe and therefore assert that the decree of the Circuit

Court of Appeals for the Ninth Circuit herein is erroneous and that the matters and questions involved in said decision are of such grave and general importance that this Honorable Court should require the said cause to be certified to it for its review and determination, in conformity with the provisions of the Act of Congress in such cases made and provided.

WHEREFORE because of the gravity and importance of the questions involved and in the interest of uniformity of decision, your petitioners respectfully pray that a writ of certiorari may be issued out of and under the seal of this Court, directed to the Judges of the United States Circuit Court of Appeals for the Ninth Circuit commanding them and each of them to certify and send to this Court on a day certain to be therein designated, a full and complete transcript of the record and of the proceedings of the said Circuit Court of Appeals in the case lately depending thereon entitled "James M. Hyde, Appellant, *versus* Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, Appellees, No. 2346," to the end that the decree of said Circuit Court of Appeals in said case may be reviewed as provided in Section 6 of the Act of Congress entitled "An Act to establish Circuit Courts of Appeals and to define and regulate in certain cases the jurisdiction of the Courts of the United States, and for other purposes," approved March 3, 1891, and that your petitioners may have such other and further relief or remedy in the premises as to this Court may seem appropriate and in conformity with the said Act and that the said decree of the said Circuit Court of Appeals in the said case, and every part

thereof, may be reversed by this Honorable Court.

And your petitioners will ever pray.

Minerals Separation, Limited,
By S. GREGORY,
Director.

Minerals Separation American
Syndicate, Limited,
By S. Gregory,
Director.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
FREDERIC D. MCKENNEY,
JOHN H. MILLER,
ODELL W. MCCONNELL,
Counsel for Petitioners.

State of New York,
County of New York, } ss.:

HENRY D. WILLIAMS being duly sworn says that he is of counsel for the petitioners Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited; that he has read over the foregoing and annexed petition and knows well the contents thereof, and that he has also carefully read and studied a duly certified copy of the transcript of record under the seal of the United States Circuit Court of Appeals for the Ninth Circuit in the case of James M. Hyde, Appellant and Defendant, versus Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, Plaintiffs and Appellees; that the matters of fact

stated in said petition are fully supported in and by said transcript of record and are true to the best of his knowledge, information and belief.

Subscribed and sworn to before me
this 30th day of September, 1914.

HENRY D. WILLIAMS.

HARRY C. LEWIS,
Notary Public,
(Seal) Bronx Co. No. 36.
Certificate filed in New York County No. 88.

In our opinion the foregoing and annexed petition for certiorari is well founded in law.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
FREDERIC D. McKENNEY,
JOHN H. MILLER,
ODELL W. McCONNELL.

SUPREME COURT OF THE UNITED STATES.

MINERALS SEPARATION, LIMITED and MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED,

Petitoners and Complainants,

against

JAMES M .HYDE,

Respondent and Defendant.

Brief in Support of Petition for Writ of Certiorari.

The present suit involves the validity of the United States patent for an invention which is undoubtedly one of the most important inventions in the metallurgical arts, which is widely patented and widely used, the patent for which is shown to be respected in Great Britain, Australia, Russia, Sweden, Chile and Cuba and is in fact unchallenged in all the twenty-six countries in which it is patented except in the United States. The decision of the Ninth Circuit Court of Appeals holding the invention to be anticipated and unpatentable is in conflict with a judgment of the House of Lords of England and a judgment of the Privy Council of the British Empire wherein the same invention and important patents of the prior art received careful consideration. It is submitted that this court should call before it a suit involving an invention of such world wide importance, and not permit the United States patent for such

an invention to be destroyed by the adverse judgment of the Ninth Circuit Court of Appeals in conflict with the highest courts of Britain and the British Empire, and also, it may be added, in conflict with the decision of the trial court from which the appeal was taken, as to essential matters of fact as well as law.

The invention is essentially simple. The ore is ground to powder, mixed with a considerable amount of water to form a freely flowing pulp, a frothing agent, oil in this instance, added, in such minute quantity as to amount to one-tenth of one per cent. of the ore, two pounds to the ton of ore and four tons of water, the mixture is violently agitated, and then run into settling vessels or spitzkasten, and a froth rises to the surface carrying the valuable mineral particles, while the worthless rock or gangue particles settle in the liquid. This mineral froth, inches thick upon the surface of the liquid, is composed of air bubbles armored with metallic particles, and when this froth is floated off it is found to contain very nearly all the metallic content of the ore. The heavier metal particles have been floated to the surface. The lighter gangue or rock particles have sunk to the bottom. Gravity has been reversed by the new phenomenon of the agitation froth. The process has been and is largely used in the concentration of copper, lead and zinc ores, and millions of dollars worth of valuable metal have been and are being recovered by this process, largely from dumps and waste products, for the benefit of mankind.

It is submitted that the present suit presents a question such as this Court should take cognizance of. The good faith of our country is involved. The owners of the patent are British companies,

of London, England. They have gone to great expense in the introduction of the invention. As the Ninth Circuit Court of Appeals says:

> "It is in evidence that in making the process known to the public in the United States the appellees have expended $60,187" (Rec., p. 1288).

And this, it may be added, does not include any of the expenses of litigation (Rec., p. 840), nor does it include any of the expense of the long period of research which culminated in the invention, and of the further development of the invention abroad and perfection of apparatus for its use, involving roughly half a million dollars.

In *Westinghouse* v. *Wagner*, 225 U. S., 604, 614, this Court said:

> "The writ was issued in view of the holding that, though the Master found that the defendant had made a profit of $132,000 from the sale of infringing transformers, the plaintiff could vet only recover $1, because it failed to separate the profits made by its patents from those made by the defendant's addition."

Here petitioners' inventors have discovered and disclosed, to the profit of the defendant and the metal industry of the entire world to the extent of many million dollars, a process which the Circuit Court of Appeals of the Ninth Circuit admits was novel and so useful that it has "gone into extensive and successful use" and yet denies to it the benefit of the patent laws of this country on the ground that this admitted novelty introduced no new mode of operation and effected no new result in kind, as to which simple issue of law and fact the highest courts of the British Empire have reached the contrary conclusion. Again we have British subjects who have invested a half million dollars

in an invention in reliance upon the integrity of the patent systems of the United States and other countries, whose patent in the United States will be destroyed, upon assumptions widely variant from the conclusions of the home courts of the litigants, if this petition be not granted. It may be noted that the Ninth Circuit includes nearly all of the rich mineral part of our country.

It is submitted that the general statement of this Court as to the reasons controlling its exercise of the writ of certiorari is applicable here. Such writs are to be issued

> "only when the circumstances of the case satisfy us that the importance of the question involved the necessity of avoiding a conflict between two or more courts of appeal, or between courts of appeal and courts of a state, or some matter affecting the interests of this nation in its internal or external relations, demands such exercise" (Forsyth v. Hammond, 166 U. S., 506, 514, 515).

Conflict exists between courts of appeals in this country and in Great Britain as to the principle and operation involved in the process in issue and as to the legal effect of prior disclosures. Conflict also exists between Circuit Courts of Appeal in this country as to the effect of an application for a patent filed in the Patent Office and maintained in secrecy therein until the issuance of the patent, such issuance being at a date too late to constitute an anticipation.

This Court has held that the statutes do not warrant treating such an invention as anticipative, but the holding was limited to the particular defense of prior patenting. The controlling decision is *Bates* v. *Coe,* 98 U. S., 31. There the second defense was

"That the improvement had been patented or described in some printed publication prior to the supposed invention."

Mr. Justice Clifford says (p. 33):

"Evidence to sustain the second defense is sufficient if the patent introduced for the purpose, whether foreign or domestic, was duly issued or the complete description of the invention was published in some printed publication prior to the patented invention in suit; and the patent offered in evidence or the printed publication will be held to be prior, if it is of prior date to the patent in suit, unless the patent in suit is accompanied by the application for the same, or unless the complainant introduces parol proof to show that his invention was actually made prior to the date of the patent, or prior to the time the application was filed.

"Neither the defendant in an action at law nor a respondent in an equity suit can be permitted to prove that the invention described in the prior patent, or the invention described in the printed publication was made prior to the date of such patent or printed publication, for the reason that the patent or publication can only have the effect as evidence that is given to the same by the Act of Congress. Unlike that, the presumption in respect to the invention described in the patent in suit, if it is accompanied by the application for the same, is that it was made at the time the application was filed; and the complainant or plaintiff may, if he can, introduce proof to show that it was made at a much earlier date."

In *Drewson* v. *Hartje Paper Mfg. Co.*, 131 Fed., 734, C. C. A., 6th Circuit, it appears that a certain patent to Symons was pleaded in the answer as an anticipation, whereas it was not issued until September 3, 1895, after the filing on June 12, 1895,

of the application for the Drewson patent in suit. The Court said:

> "Symons applied for his patent January 17, 1905, several months before the date of the filing of the Drewson application. The date of the first application, in the absence of any other evidence of the date of an invention, must be taken as establishing the date of the first invention. It follows, therefore, that the patent to Symons not only has the earlier issue date, but prima facie covers the earlier invention, and was therefore entitled to be regarded as an anticipating patent" (p. 739).

This contravenes the doctrine of Bates v. Coe, *supra.*

In *Electric Controller Co.* v. *Westinghouse Co.*, 171 Fed., 83, C. C. A., 6th Circuit, Drewson v. Hartje Paper Mfg. Co. was cited and followed and consideration was given to two patents issued after the filing of the application for the patent in suit, by reason of the fact that the applications for these patents were filed prior to the filing of the application for the patent in suit, although it was held after full consideration, that these patents did not in subject matter anticipate the invention of the patent in suit.

These two cases in the Sixth Circuit were cited by defendant-appellant in the present suit as authority for a consideration of the two later patents of Schwarz and Kirby as anticipations of the invention in issue, and the Circuit Court of Appeals of the Ninth Circuit, without reference to any authorities, rendered its decision in harmony with these cases in the Sixth Circuit, holding that these two patents were prior art.

Opposed to these decisions are numerous decisions in the Second, the Third and the Eighth Cir-

cuits, but a prominent example, particularly applicable to the present suit by reason of the fact that Kirby was a resident of Canada, is *Vacuum Engineering Co.* v. *Dunn,* 209 Fed., 219, C. C. A., 2nd Circuit. Here an alleged anticipating patent to a foreigner, Schiodt, was granted, after the filing of the application for the Locke and Dunn patent in suit, on an application filed earlier than the earliest proved date of the origin of the Locke and Dunn invention. The Court said:

> "Under section 4923, U. S. R. S., Locke and Dunn, original inventors, could not be defeated by knowledge of the invention in a foreign country, when not patented or published there. It makes no difference that the person in the foreign country having such knowledge was also an inventor. Appellant seeks to avoid the statute on the theory that the foreign inventor 'gave the American public a knowledge of his invention through the Patent Office' when he filed his application. But in reality by that act he gave the American public nothing. His application was confidential; the public could not see it or be informed of its contents until patent issued upon it. Before that date came Locke and Dunn with their application. Under these circumstances we do not see how the Schiodt patent can be considered 'prior art.' See our opinion in *Westinghouse Mfg. Co.* v. *General Electric Co.*, 207 Fed., 75."

It may be noted that in the case above quoted the defendant was estopped from attacking the validity of the patent, and could only show that the claims were of limited scope by reason of the limitations imposed by the prior art. This does not affect the reasoning of the decision, however, as appears in the prior case in the Second Circuit Court of Appeals cited as express authority. In

this case, *Westinghouse Mfg. Co.* v. *General Electric Co.*, 207 Fed., 75, prior to the earliest proved date of an invention by Armstrong, an invention was made abroad by De Kando and reduced to successful practice abroad, and an eminent American electrician went abroad, had the invention fully explained to him, inspected its operation, came back to America with this knowledge and a full and elaborate description of the invention, made a written report of the invention shortly after his arrival here, at various times explained the invention here to electrical engineers of standing, and gave a public explanation of the invention at a meeting of the American Institute of Electrical Engineers. All this happened before the earliest acceptable date of origin of the Armstrong invention, to wit, the date of filing of the Armstrong application. De Kando subsequently filed an application for a patent. The two applicants claimed the same invention and contended in the Patent Office for identical claims. A patent was refused upon the ground that Armstrong was the first inventor. The Court of Appeals of the District of Columbia affirmed this judgment (*De Kando* v. *Armstrong*, 37 App. D. C. 314). The Circuit Court of Appeals of the Second Circuit accepted the findings of fact and law of the District Court of Appeals and said:

> "Reduction to practice in a foreign country can never operate to destroy a patent applied for here, however widely known such reduction to practice may be, either among foreigners or among persons living here, unless the invention be patented or described in a printed publication."

And in *Vacuum Engineering Co.* v. *Dunn, supra*, the same principle was carried further and it was

held that the filing of an application for a patent in this country for the invention of a foreigner could not operate to modify or destroy a patent applied for here, even though that application subsequently resulted in the grant of a patent prior to the grant of the patent in issue.

As to the legal effect to be given to the fact that prior processes were unsuccessful and had not gone into use and the process of the patent in suit was successful and largely used, coupled with the fact that there was a material difference between the unsuccessful prior processes and the successful process of the patent in suit, the Circuit Court of Appeals of the Ninth Circuit has erred in applying to a case of different prior disclosure the rules of law applicable only to a case of the same prior disclosure. Obviously where the prior disclosure is the same and is full, complete, definite and clearly comprehensive, the fact that no use was made of this prior disclosure is not important. On the other hand where the prior disclosure required alteration, a strong presumption arises from the fact that no use has been made of this prior disclosure, of the patentability of the invention which has been successfully and largely used. In *Carnegie Steel Co.* v. *Cambria Iron Co.*, 185 U. S., 403, this Court gave consideration to a somewhat similar case. This Court, speaking through Mr. Justice Brown, said of a defence at pages 421, 422:

> "This defence presents the common instance of a patent which attracted no attention, and was commercially a failure, being set up as an anticipation of a subsequent patent which has proved a success, because there appears to be in the mechanism described a possibility of its having been, with some alterations adaptable to the process thereafter discovered. As here-

> inafter observed, a process patent can only be anticipated by a similar process."

Again as to all supposed anticipatory devices this Court said at page 424:

> "Granting that some of these devices may have been made use of to carry out the Jones process, none of them in practical operations seems to have been effective to secure the desired result. A process patent, such as that of Jones, is not anticipated by mechanism which might with slight alterations have been adapted to carry out that process, unless, at least, such use of it would have occurred to one whose duty it was to make practical use of the mechanism described. In other words, a process patent can only be anticipated by a similar process."

Consideration is then given to the things essential to carrying out the Jones process in suit, and it was said at page 425:

> "None of the prior patents or processes to which we are referred meets these requirements. Indeed, it is scarcely too much to say that none meets more than one of them. When we add to this that none of them was ever used, or was ever susceptible of being used, without material alteration to carry out the Jones process, it is evident that the defense of anticipation by prior patents rests upon a slender foundation."

So in the present suit the Circuit Court of Appeals of the Ninth Circuit said that the reduction of the quantity of oil to a small fraction of one per cent. was not disclosed in any of the prior patents, and the evidence clearly shows that none of the processes on which the Court relies for anticipation was ever used or was ever susceptible of being used.

In conclusion as to prior devices and disclosures this Court said in *Carnegie Steel Co.* v. *Cambria Iron Co., supra,* at page 446:

> "The surprise is that the manufacturers of steel, having felt the want for so many years, should never have discovered from the multiplicity of patents and of processes introduced into this suit, and well known to the manufacturers of steel that it was but a step from what they already knew to that which they had spent years in endeavoring to find out. It only remains now for the wisdom which comes after the fact to teach us that Jones discovered nothing."

and then cited the decision of this Court in *Loom Co.* v. *Higgins,* 105 U. S., 580, 591, from which the following quotation is made:

> "But it is plain from the evidence, and from the very fact that it was not sooner adapted and used, that it did not for years occur in this light to even the most skilful persons. It may have been under their very eyes, they may almost be said to have stumbled over it; but they certainly failed to see it, to estimate its value, and to bring it into notice * * * * Now that it has succeeded, it may seem very plain to any one that he could have done it as well. This is often the case with inventions of the greatest merit. It may be laid down as a general rule, though perhaps not an invariable one, that if a new combination or arrangement of known elements produces a new and beneficial result never attained before, it is evidence of invention."

It may also be noted that the two cases above cited and quoted and other decisions of this Court were considered and cited by Judge Bourquin in the decision from which appeal was taken to the Circuit Court of Appeals of the Ninth Circuit (Rec., p. 41). Judge Bourquin's presentation there of the decisions of this Court can hardly be im-

proved upon, and his quotation (Rec., p. 42) from the case of *Diamond Rubber Tire Co.* v. *Consolidated Rubber Tire Co.,* 220 U. S., 428, 435, is here repeated:

> "Knowledge after the event is always easy. * * * * But the law has other tests of the invention than subtle conjectures of what might have been and yet was not."

Upon the case made out in the petition it is respectfully submitted that the writ of certiorari addressed to the Judges of the United States Circuit Court of Appeals of the Ninth Circuit should be issued as prayed.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
FREDERIC D. McKENNEY,
JOHN H. MILLER,
ODELL W. McCONNELL,
Counsel for Petitioners.

Notice.

To Thomas F. Sheridan,
Walter A. Scott,
J. Bruce Kremer,
Counsel for James M. Hyde.

Gentlemen:

Will you please take notice that on Monday the 26th day of October, 1914, at 12 o'clock noon, or as soon thereafter as counsel may be heard, the foregoing petition and accompanying brief will be submitted to the Supreme Court of the United States at its usual place of holding its sessions in the Capital at Washington, D. C. for its consideration and action, at which time and place you will please take such action in the premises as you may be advised.

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
FREDERIC D. McKENNEY,
JOHN H. MILLER,
ODELL W. McCONNELL,
Counsel for Petitioners.

Admission of Service.

Service of a copy of the foregoing petition, brief and notice is acknowledged this 3rd day of October, 1914.

Thomas F. Sheridan
Walter A. Scott
J Bruce Kremer
Counsel for James M Hyde

APPENDIX.

HOUSE OF LORDS.

ON APPEAL
FROM HIS MAJESTY'S COURT OF APPEAL
(ENGLAND).

Tuesday, 16th November, 1909.

Lords present—

EARL OF HALSBURY.
LORD ASHBOURNE.
LORD ATKINSON.
LORD SHAW OF DUNFERMLINE.

MINERALS SEPARATION LIMITED
Appellants

v.

BRITISH ORE CONCENTRATION SYNDICATE LIMITED, AND ANOTHER
Respondents.

Judgment.

THE LORD CHANCELLOR (read by the EARL OF HALSBURY): My Lords, the Plaintiffs commenced this action against the Defendants in respect of alleged infringement of two separate patents, F. E.

Elmore's of 1898 and A. S. Elmore's of 1901. In regard to the patent of 1898 it is not now contended that there has been any infringement. In regard to that of 1901, the Court of Appeal, therein reversing Mr. Justice Neville, held that the Defendants have infringed. They also found that the patent was valid.

Elmore's patent of 1898, related to a process for separating the metallic from the rocky constituents of pulverized ore. He mixed the pulverized ore with water so as to make in effect a pulp. Then he added thick oil. In the result the water with the rocky substance, or gangue, as it is called, remained at the bottom of the vessel. The thick oil entrapped the metallic particles and floated them to the surface, where they were run off. Repetition of the process enabled substantially all the metal to be recovered.

I thus roughly summarise the invention of 1898, merely to dismiss it from further consideration. Since it has been admitted that there is no infringement of this patent, I cannot see that it has any place in the present controversy, into which it has nevertheless been introduced with no other result than to confuse the issue by irrelevant considerations.

Three years after the date of F. E. Elmore' patent, his relative, A. S. Elmore, thought that he had made a fresh discovery, and took out his patent of 1901. This is the patent which the Court of Appeals have found the Defendants guilty of infringing. So it is crucial to determine what the alleged invention of 1901 is, and how it is described in the specification. Everything turns upon the construction of this document.

I think the claim of 1901 is for the addition of

acid to any mixture consisting of pulverised ore, water and oil which is used for the separation of mineral substances from the rocky constitutents of ore by means of the selective action of oil.

In this specification the patentee distinguishes between what is old and what is new. He tells us how the selective action of oil has been utilised and how the separation has generally been done. After that he tells us of his discovery. In carrying on this separating process he has discovered that the selective action of oil is enhanced by acidulation. That much he asserts is a new discovery. All the rest of the process described he asserts to be generally used.

The document is framed with great subtlety, being partly narrative, partly claim, so woven together that it is not easy to determine how much of that which is contained in the narrative ought to be read into the claim. I have no doubt that this was designed in order that the claim might be expanded or contracted as occasion might require in the interest of the patentee.

Disentangled, in effect, the specification amounts to this: "There is already in use a process or processes for separating mineral substances from rocky substances by the selective action of oil in a mixture of ore, water and oil. Generally, there is a considerable quantity of water so as to make a freely flowing pulp, before the oil is mingled with it. Preferably, thick oil is used, though not necessarily. Whether you use a considerable quantity of water or not, whether you use thick oil or thin, whether you use a few pounds of oil or several tons of oil to treat one ton of ore, I claim the sole right to add any acid. I do not tell how much or how little acid is to be used. That varies according to the character of the material treated."

Let me put the same thing in another way. At the end of the specification the patentee formulates his claim as follows. It is: "The method herein described of promoting the separation of mineral substances by the selective action of oil, by adding to the mixture of ore, water and oil, a proportion of acid."

What is "the mixture" here spoken of? For that we should look to the earlier paragraphs. It is not one which must at any stage be a freely flowing pulp, only it is so generally. It is not one that must contain heavy oil, though it is so preferably. It may contain any proportion of water, any proportion of oil, and therefore any proportion of pulverised ore. In other words, "the mixture" is any mixture of the named three substances.

I greatly regret to differ from the Court of Appeal in this case, but it seems to me that when this very skilfully drawn specification is closely read, the only claim is for acidulation, the only discovery alleged is the merit of acidulation, and the process to which acid is to be applied is described in terms so wide that it covers any process, certainly any known process, of separating mineral substances by the selective action of oil in a mixture of ore, water and oil.

I cannot agree with Lord Justice Moulton that the claim in this specification is to "the use of a small amount of added acid in the process described in the specification, *i. e.*, in a process where the ore is pulverised and suspended in water so as to make a freely flowing pulp, and is mingled with oil so as to cause a selective flotation." The specification expressly says it is not confined to any definite proportion of acid. And, what is more important, the making of a freely flowing

pulp is only stated to be what is generally done. It is not claimed as an essential feature of the mixture to which acid is to be added.

It is this definition of the 1901 claim, erroneously as I respectfully think, which lies at the root of the Judgment of the Court of Appeal.

The construction which I place on the document opens a door to arguments against its validity, other than those that were used before your Lordships. I have, however, no difficulty in deciding this case on grounds which were fully argued.

A. S. Elmore did not discover that the addition of acid to a mixture of pulverised ore, water and oil enhanced the selective action of the oil in separating mineral substances from the rocky constituents of ore. That is distinctly stated in Everson's Patent. In Everson's case the mixture was in a stiff mass, that means there was less water. And A. S. Elmore's Patent of 1901 is so wide in its claim that it includes any mixture whether in a stiff mass or in a flowing pulp, with more water or with less.

Nothing can turn upon any distinction resting upon the order in which water, oil and acid respectively are applied to the pulverized ore. For the Patent of 1901 does not impose any order.

Accordingly, I am of opinion that the patent of 1901 cannot be sustained, and that the Judgment of the Court of Appeal should be reversed.

I desire to add that if, in view of the documents and the evidence, I could have been convinced in favour of the Respondents, Mr. Walter's argument would have convinced me. It was all the more effective on account of its conciseness, and I confess that it shook my opinion at the time. But, on mature reflection, I am not able to adopt it.

EARL OF HALSBURY: My Lords, I am of opinion that the two inventions are essentially different. I mean by the two inventions those which might be technically described, the one upon the selective action of oil, the other upon surface tension. That the two processes are in these respects totally different cannot be denied, and the acidulation which is supposed to incriminate the latter process with infringement is common to the first process and to another which was invented and patented before it.

I do not propose to deal with these propositions since I entirely agree with what the Lord Chancellor has said on the subject and I do not know that I should have added anything to his judgment but for two observations to which I am impelled by something I read in the judgment of the Court of Appeal and, indeed, in one observation of Mr. Justice Neville. One observation refers to the extremely ambiguous and difficult character of the specification. The statute requires it to be a distinct specification of what is the invention. In construing the specification one has to remember that it is a document not only assuring a monopoly to the patentee, which but for the statute would be contrary to the common law, but so prohibiting any one other than the patentee doing what he would be free to do but for the right which is granted subject to the condition, among other things, that he states distinctly what his invention is. If he designedly makes it ambiguous, in my judgment the patent would undoubtedly be bad on that ground; but even if negligently or unskillfully he fails to make distinct what his invention is, I am of opinion that the condition is not fulfilled and the consequence would be that the patent would be bad.

The other observation which I wish to make refers to a passage in the judgment of the Court of Appeal which I think, with the greatest respect which I entertain for the learned judges seems to authorise a somewhat lax interpretation of the principle of what prior publication of an invention will render a patent invalid. It is of course impossible to lay down an abstract rule where questions of fact and degree come into play, and the judgment of the Court of Appeal seems to me to substitute the words "material for the public to know" for a much simpler phrase, there must be invention.

Now, I have said elsewhere, there must be invention, whether that invention is to be ascertained by considering something originally discovered or by considering a combination producing a new result; it cannot but be certain that the statute of monopolies and the whole branch of the law make it an absolute condition to the validity of a patent that there should be what may properly be called invention and the application of well-known things to a new analogous use. This is what I said myself in the case of Morgan v. The Windover Company (Reports of Patent Cases, No. 7). I quote it not because I said it myself, but because in saying it I had the assent of Lord Watson, Lord Herschell and Lord Morris, and indeed I was only re-affirming that had been said by Lord Westbury in Harwood v. The Great Northern Railway Company, who gave a warning which appears to me especially needed now, when he said "I think the law on this subject is rightly settled, for there would be no end to the interference with trade and with the liberty of adapting any mehanical contrivance" (in that case the patent was a mechanical one) "if any slight

difference in the application of a well-known thing should be held to constitute ground for a patent."

To apply the proposition which I think is intended to be conveyed by the part of the judgment to which I am referring would, I think, if applied to the facts as disclosed here, be absolutely untenable. I think the dilemma put by Mr. Justice Neville is absolutely unanswerable.

I wish to add how heartily I concur in what the Lord Chancellor has said as to Mr. Walter's argument, and I concur in his judgment.

LORD ASHBOURNE: My Lords, I concur.

LORD ATKINSON: My Lords, in this case an action was brought by the present Respondents against the Appellants for infringement of two letters patent—viz., No. 21948 of 1898 granted to Francis Edward Elmore and No. 6519 of 1901 granted to Alexander Stanley Elmore. Mr. Justice Neville, by whom the case was tried, found that the earlier of the two was valid, but that the Defendants had not infringed it.

He did not arrive at any specific conclusion as to the validity of the second patent, but held that if the true construction of the specification appended to it was such that it would be infringed by what the Defendants, the present Appellants, had done, it would be invalid for want of novelty. He, therefore, dismissed the whole action. The Court of Appeal upheld the Judgment of Mr. Justice Neville as to the patent of 1898, but set it aside as to the patent of 1901, and made an order that judgment should be entered for the present Respondents as to this latter, for an injunction, and an inquiry as to damages, and for certain consequential relief. This Appeal is presented against so much of the Order of the Court of Appeal as

touches the patent of 1901, and the consequential relief granted in respect of the infringement of it. The decision of the case turns wholly upon the construction of the complete specification appended to this patent.

This specification appears to me to have been framed, somewhat craftily, in terms of studied vagueness and ambiguity. The process, protected by the patent of 1898, while not directly alluded to, is fairly accurately described in a historical narrative contained in the first paragraph of the specification; but that process is not adopted formally, or expressly as the particular process to be improved upon by the invention of the respondents, namely, the acidulation, in the manner described of the mixture of oil, water, and pulverised ore, with which the first patent is conversant. In the specification attached to the first patent, thick oil was directed to be added to a mixture of water and pulverised metallic ore, and no specific mention was made of the required consistency of the mixture before or after this addition. But a much wider scope and application is sought to be given to the second patent than if that course had been adopted, not by reason of any direct and positive statement contained in the specification but the introduction, almost furtively, as it were, into this historical narrative of two phrases, namely, the phrase, "preferably heavy oil," and the phrase "freely flowing pulp"; while at the same time those phrases are such that they could be relied upon, should occasion arise, to narrow the invention claimed into something less wide than the mere introduction of acid into a mixture, of whatever consistency, containing oil, water, and powdered ore in any relative quantities.

The Respondents insist, rightly, I think, that the earlier patent must, for the purposes of this appeal, be put out of view, and that the language of the specification of 1901 can alone be looked to in order to determine what the precise nature of the invention claimed, in the later patent, really is. The consequence is that your Lordships are left to choose between the only three constructions of which the specification of 1901 is reasonably susceptible, and, therefore, to decide whether the invention claimed consists (1) in the addition of a relatively small quantity of acid to a mixture of powdered metallic ore, oil and water, irrespective of the relative quantities or consistency of these component parts, or any combination of two of them, and irrespective also of the consistency of the mixture itself; or (2) in the addition of a similar quantity of acid to a mixture of pulverized metallic ore, water and oil of any consistency, irrespective of the proportion in which the oil may be present relatively to the other ingredients, provided only that the water and ore or water, oil and ore, whichever it may be, have been reduced to a "freely flowing pulp"; or (3) in the addition of a similar quantity of acid to a mixture of powdered ore, oil and water, the quantity of oil not being relatively infinitesimal, but so large that having in accordance with some obscure chemical law or affinity seized upon the minute metallic particles of the powdered ore in preference to the earthy particles, it by its own buoyancy floats the former to the surface.

It could not, in my opinion, be successfully disputed that the invention claimed must be one of these three.

If it be the third of them then the Appellants

have not infringed, because, though in their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles, which, introduced into the mixture by the more or less violent agitation of it, envelop or become attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water. And if it be the first of them which is really claimed, then it was clearly established that the invention was anticipated by the invention patented in the United States by one Carrie J. Everson, in the year 1886, and the patent of 1901 is therefore bad for want of novelty.

There only remains invention No. 2. If that be the invention claimed, the Appellants have undoubtedly infringed; on any other supposition the Respondents must fail.

But taking the specification as a whole, it is not possible, in my opinion, to hold that the invention claimed lies in the mere addition of acid in small quantities to a mixture of ore, water and a relatively infinitesimal quantity of oil reduced to a "freely flowing pulp." That is the construction contended for by Mr. Walter in his brief but clear and able argument.

There is not in the specification any express mention of the use of an infinitesimal quantity of oil. There is not a phrase in it which suggests it. There is no indication of the relative quantity of oil to be used, save what is contained in its first

and fourth paragraphs; and the reasonable inference to be drawn from these, the inference which I think any mechanic or workman skilled in the extraction of mineral matter from ore would draw, is that the oil is to be used in considerable quantity. In the first paragraph the mode is described in which the oil is to be separated from the metallic particles after it has seized them and lifted them to the surface, namely, usually by centrifugal action. In the fourth paragraph it is stated that the acid added need not exceed one five-hundredth part of the volume of oil or water, as if the quantities of oil and water were to be the same. The measure here provided for the acid would appear to be rather ridiculous if applied to oil, which is itself present in only relatively infinitesimal quantities.

The quantity of oil used by the Appellants' process is only two or three pounds in weight to the ton weight of water or of oil and water, whichever it be. The five-hundredth part of this would roughly amount to about one-tenth of an ounce. The five-hundredth part of a ton would amount to about 7½ pounds. So that to acidulate a ton weight of this mixture, the option would be left to the operator to employ either one-tenth of an ounce of the acid, or over 1,130 times as much, namely, 7½ pounds of it. It is scarcely possible to believe that such a small quantity of acid as the one-tenth of an ounce would have any effect whatever upon a ton of the mixture; but if it would, then it is scarcely possible to believe that 7½ pounds of acid would not have an injurious effect. The whole passable would indeed seem rather absurd if applied to a process such as the Appellants', and leads, I think, irresistibly to the conclusion

that the specification provides for the addition of a considerable quantity of oil.

The invention described, if indeed it be an invention at all as distinct from a discovery, is therefore in my opinion, not the second but the last of the above-mentioned three.

If so the Appellants have not infringed. For this reason I think the judgment of the Court of Appeal was erroneous and should be reversed, and this Appeal allowed with costs.

LORD SHAW OF DUNFERMLINE: My Lords, the action, out of which this Appeal arises, was brought by the Respondents the Plaintiffs, to prevent the Appellants, the Defendants, from infringing two letters patent, viz., that of Francis Edward Elmore numbered 21948 of 1898, for "Improvements in separating metallic from rocky constituents of ores, and apparatus therefor" and that of Alexander Stanley Elmore numbered 6519 of 1901 for "An improvement in separating mineral substances by the selective action of oil." The action was tried before Mr. Justice Neville, who held that the Defendants had not infringed either patent. Quoad the patent of 1898, that judgment was affirmed by the Court of Appeal. With regard to the patent of 1901, viz., "An improvement in separating mineral substances by the selective action of oil," Mr. Justice Neville's judgment was reversed, injunction granted, and an enquiry ordered as to damages.

My Lords, were it not for the regard which I entertain for the experience and learning of Lord Justice Fletcher Moulton especially in this class of suits, and second, for the fact that a somewhat new development was made of the argument upon the interpretation of the patent of 1901, I should have

contented myself with simpliciter affirming the judgment of Mr. Justice Neville, which seems to me to have reached a sound result, after covering with care and completeness the whole grounds of the case. I am of opinion that your Lordships should revert to that opinion and that the appeal should be allowed.

As it now stands, the judgment of both Courts with regard to the patent of 1898 is not challenged and it is conceded that the Defendants have not infringed that patent. It is further conceded that certain references may require to be made to it for the purpose of a proper construction of the subsequent patent of 1901; but, my Lords, I think this is a process which should most sparingly be employed. And it humbly appears to me that the construction of the patent of 1901 furnishes sufficient material for the determination of the case without undue reference to the earlier patent to which I have referred. The complete specification thus begins: "The selective action of oil has been utilised for separating metallic substances from earthy or rocky constituents of ores. This has generally been done by pulverising the ore, and suspending it in a considerable quantity of water so as to make a freely flowing pulp, then mingling with it oil, preferably heavy oil, such as is obtained from petroleum after some of the lighter oils have been distilled from it. When the mixture rests, the oil, with most of the metallic substances entrapped in it, floats at the top, and is separated from the rocky or earthy matters, which are run off with the water as tailings. The oil is afterwards separated from the metallic substances usually by centrifugal action. In carrying on this separating process I have discovered that in some

cases a slight acidulation of the mixture greatly enhances the selective action of the oil, so that metallic substances, as well as other mineral substances, such as sulphur and plumbago, can be separated from the earthy matters with which they are naturally associated better than when there is no acid present. By this means some metallic substances can be separated from others, such, for instance, as "sulphides from oxides." What, my Lords, is the discovery or invention which the patentee thus records that he has made? It is a discovery that in some cases acidulation enhances the selective action of the oil, and this occurs "in carrying on this separating process." What, then, is "this separating process' thus described? For this a reference must be made to the previous paragraph, in which an historical account is given of that process. It is conducted by pulverising the ore, suspending it in water so as to make a freely flowing pulp and mixing it with oil. The separation process is effected at what, I think, is a vital point in illustrating this specification, viz., "when the mixture rests." When this mixture thus rests two laws operate—(1) the affinity of oil for metal and of water for rocky or earthy material, and (2) the lesser specific gravity of oil, which floats to the top of the mixture, carrying with it the particles of metal and separating itself, the oil with the metal, from the remaining constituents of the mixture, viz., the water with the rock or earth. These are familiar laws and specially pointed to as operative when the mixture is at rest. That is the separating process which the inventor described, and I feel quite convinced that he had no other process in his mind. I say so irrespective of the fact that the oil is described as "preferably heavy." I

think that "preferably heavy" simply meant that a heavy oil would be preferred as an entrapping material for the particles of metal; but whether the oil was heavy or was light I think it was oil in bulk that was pointed to, and I cannot think that any other natural laws than the two that I have referred to were contemplated. By this operation the separation by flotation and sedimentation was effectively achieved. That it was oil in bulk which was before the inventor's mind is made very clear by the later passage in the specification, which refers to the quantity of acid being small, "as it often need not exceed one five-hundredth part of the volume of oil or water employed in the operation." As is shown by Mr. Swinburne's evidence, the quantity of oil required in working this patent is from one to two-and-a-half tons per ton of ore to be treated.

The specification ends with the claim in the following terms, viz., "The method herein described of promoting the separation of mineral substances by the selective action of oil by adding to the mixture of ore, water and oil a proportion of acid." In the most able argument presented at your Lordships' Bar by Mr. Astbury the following paraphrase of the claim was offered—viz.; "In a process where the selective action of oil is used for separating metal from gangue in a freely flowing pulp the addition to the mixture of ore, water, and oil of a proportion of acid in the manner described for promoting or enhancing the oil's separation." If this paraphrase is only meant to accentuate the point of the acidulation, it is of course allowable; but I do not think that this removes from the claim, or relegates to a subsidiary position therein, the claim for a method—viz., a method of pro-

moting the separation of mineral substances. That method is the method "herein described."

My Lords, either (1) the mixture was one in which when at rest, or nearly at rest, the flotation in bulk of oil with entrapped particles of mineral took place and the "method described" was an addition of acid to a mixture of that character for the purpose of promoting a separation therein; or (2) it was a claim to add acid to any mixture of ore, oil and water, however thick or thin, whether capable of supporting to the surface particles of mineral when the mixture was at rest, or incapable of doing so except with the aid of other natural agencies. The latter is a very wide interpretation amounting to a claim by the inventor of a monopoly in the acidulation of a mixture of oil, ore and water under any circumstances, and to this I shall make subsequent reference. But, my Lords, in my opinion the former is the correct interpretation. I think the invention meant that, and indeed, thought only of that, and that the reader of the specification and claim would so understand it. The question is, have the Appellants infringed this patent?

In order to determine this question it is necessary to look at the patent under which they work, viz., 7,803, of 1905, for "Improvements in or relating to ore concentration," granted to Sulman Picard and Ballot. The complete specification is dated 2nd June, 1905. My Lords, one cannot peruse that specification without being struck by the fact that at all events the mixture to which the application of acid was to be made was of a very different character to that described in the Elmore patent. And the striking difference occurs in this, that the oil in the Appellants' mixture, in-

stead of being from one to two-and-a-half tons per ton of ore to be treated is only from two to three pounds per ton of ore to be treated.

The next contrast is this. As already shown the natural law relied upon in the Elmore patent was the lesser specific gravity of oil which, operating in bulk upon the mineral particles, would carry them to the surface of the mixture when it rested, and thus effect the separation aimed at, viz., the separation of those mineral particles from the rest of the ore. But it would have been absolutely impossible for such flotation and separation to have occurred with the minute fraction of oil used in the Appellants' process, however much acidulation had been employed. As Mr. Swinburne says, in his answer to Mr. Justice Neville, "1340. In Elmore's process with the drum revolving two or three times a minute, would that produce any practical result in the way of capillarity?—No. Your Lordship is taking the case of two-and-a-half pounds of oil. 1341. Yes, a very small quantity of oil?—I think what would happen would be that the oil would be all sunk with the mineral at the bottom." That is to say the method of separation "herein described" by Elmore in his patent would be promoted by acidulation; but separation would not and could not have been "promoted" by acidulation in the Appellants' 1905 process. Acidulation or none, there would have been no separation to promote; the mineral particles would not be separated by being floated off to the top, but would be sunk to the bottom with the remaining solid, viz., the gangue.

How then was the flotation of mineral particles to the top of the mixture, and thereby the method of separation of these from the gangue to be ac-

complished? My Lords, it is in the answer to that that four-fifths of the specification and claim of the Appellants consist. That is to say, they are not promoting a method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid. What is relied upon, for instance, is that "after vigorous agitation there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum."

Over and over again reference is made to such things as "the formation of froth," "the proportion of mineral which floats in the form of froth," "the warming of the mixture and the brisk agitation," and then it is stated "when agitation is stopped a large proportion of the mineral present rises to the surface in the form of a froth or scum which has derived its power of flotation mainly from the inclusion of air bubbles introduced into the mass by the agitation"; and then a very considerable portion of the apparatus is apparatus expressly designed to catch the mineral particles so buoyed up. One part of the apparatus is called the "frothing apparatus" another part is called the "froth separating apparatus," and so on. To this description it is sufficient to add that of the four claims appended to this specification of 1905 three are expressly concerned with the agitation into the froth

as already mentioned. My Lords, I cannot see my way to hold that the addition of acid to such a mixture in such a process and for the purpose of bringing about a separation by such means imports any infringement of the Elmore patent by the addition of acid in the method therein described. It has already been determined that the use of thin oil instead of thick imports no infringement of the 1898 patent, nor do I see my way to hold that there has been any contravention of the 1901 patent by the application of the acid to a mixture in which the oil has been reduced from bulk to the merest fraction, and especially when froth instead of oil has been secured, along with the law of capillarity or surface tension, as the main floating and separating agent.

It may no doubt be true that while great rapidity of agitation is required in the Appellants' process to produce the froth bubbles yet some froth bubbles are almost necessarily produced even in the Elmore mixture with its large constituent of oil in bulk. With much respect, however for the opinion of Lord Justice Fletcher Moulton, I think that far too great importance has been attached to the latter fact. I am quite certain that if it had been suggested to Elmore that the production of air bubbles was of any value or assistance in the process of separation, which he was meaning to promote, he would have repudiated the idea. And it is significant to observe that after the first flotation under the Elmore process, and when a second use of the oil is being made, the inventor himself in his complete specification says: "The oil may be pumped up to an elevated cistern to supply the drums *c* and *q*, but in order to clear the oil from air bubbles I prefer

to draw the oil up to the cistern by creating a partial vacuum in the cistern." So far was the patentee from invoking the aid of any part of his apparatus as a bubble producing machinery, that at a certain stage of the operation he did his best to eliminate the air bubbles, which were treated as a disturbing and not a helpful factor. I think that this goes far to demonstrate the limitations of the Elmore method of separation, and the striking difference between it and the Appellants' elaborate process of froth-producing apparatus. In these circumstances I cannot see my way to hold that infringement by the Appellants has occurred.

My Lords, I have already stated my view on the construction of the patent of 1901 grounded upon which my opinion as to non-infringement of the patent has been formed. But in deference to the argument submitted, I may say that had the Patent of 1901 admitted of a construction, not limited, as I have construed it, but taken in the more ample sense of a claim for the acidulation of any mixture of ore, oil and water, accompanied by the introduction of other natural agencies, and so productive of varieties of results, I should have inclined to hold that a claim in such width had been anticipated by the Everson patent.

I wish further, my Lords, to say that, while it is also not necessary to make any pronouncement on certain other parts of the most interesting opinion delivered by Lord Justice Fletcher Moulton, I should desire further consideration before assenting to those portions of that opinion which deal with the duty of the Court to ascertain the state of knowledge of the profession or trade to whom the specification is addressed, and with the

distinction figured by the learned Judge bet
the knowledge of the general public arising
published specifications and claims, and the k
edge or understanding of those who are assum
that opinion to be the true addressees, vi
"those who are skilled in the art"—such p
may raise difficulties and demand solutions w
of much excogitation, and I desire to reserve
assent on my part therefrom.

Questions put:

That the Order appealed from be reversed.

The Contents have it.

That the Respondents do pay to the Appel
the costs both here and below.

The Contents have it.

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IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1916.

No. 46.

MINERALS SEPARATION, LTD., AND MINERALS SEPARATION AMERICAN SYNDICATE, LTD., PETITIONERS-COMPLAINANTS,

vs.

JAMES M. HYDE, RESPONDENT-DEFENDANT.

PETITIONERS'-COMPLAINANTS' REPLY TO BRIEF FOR RESPONDENT.

Brief for respondent presents a fictitious case and not the case presented by the record.

A fundamental fiction, and one which it is imperative for him to establish, is that with quantities of oil greater than the minute quantity characterizing the invention in issue, agitation will evoke the same principles of action and produce the same metallurgical results.

I. In support of this proposition respondents' brief asserts that the Privy Council judgment so held in accepting the evi-

dence of Prof. Pollock in that case, quoting on pages 84 and 85, Lord Parmoor's summary of Prof. Pollock's testimony, and asserting as based on that quotation:

(Page 90, near bottom:)

> "Professor Pollock in the British litigation repudiated the idea that there was any virtue in using less then one per cent of oil. After stating that the only function of oil in the mineral separation process is permanency in the froth and minute emulsion, Prof. Pollock 'allows that there may be oil in excess, and that some of the particles may get oiled, but states that this is entirely and absolutely unessential' (transcript, bottom of page 755, and top of page 756, *supra*, page 85)."

(Page 95, line 12:)

> "Both Mr. Hyde and Dr. Byrnes testified regarding experiments in which they formed concentrate froths with amounts of oil varying from less than 1 per cent to 25 per cent by weight relative to the ore treated. This is in accord with Prof. Pollock's testimony, above quoted (*supra*, p. 85), that an excess of oil is unessential."

(Page 95, near bottom:)

> "This record shows beyond the possibility of doubt that the froth results from the use of much more than 1 per cent of oil as well as from less than 1 per cent, and Prof. Pollock testified to the same effect in the British litigation saying that an excess is unessential."

We respectfully submit that Lord Parmoor's language admits of no such inference and that the respondent absolutely misinterprets the same. In fact, the exact contrary of the inference of the respondent is the correct interpretation of what Lord Parmoor said, dealing as he and Prof. Pollock were, solely with the minute quantity of oil characteristic of complainants' process, and in speaking of "excess," meaning "excess" within that minimum *not* in addition thereto.

If what the respondent says is a misstatement and misrepresentation of Prof. Pollock's testimony it is vital that it should be corrected, because the Privy Council state, through Lord Parmoor, as quoted on page 84 of the brief for respondent:

> "There is no doubt a difference in the views of the respective experts whose standing and experience entitle them to great weight and authority; but in deciding between these views their Lordships accept the evidence of Prof. Pollock to be found in question 5780 and the following questions. This evidence may be summarized as follows:"

and then follows the summary in question.

And it is vital too that the correction should be made and Prof. Pollock's and the Privy Council's real view be correctly understood because respondent's brief concedes (p. 94, near bottom) that

> "the theory advanced by Prof. Pollock in the British litigation conforms to all of the known facts and appears to be the correct explanation."

If the language of Lord Parmoor were susceptible of any such inferences as the respondent draws therefrom, the impossibility of such inferences being warranted is made entirely manifest by adverting to "question 5780 and the following questions," to which he refers. They are as follows:

(Page 473, Printed Record in the Privy Council, No. 7 of 1912. On appeal from the Supreme Court of New South Wales in its equitable jurisdiction between The Ore Concentration Company (1905), Limited, and Australasian Ore Concentration Syndicate, Limited (Plaintiffs), Appellants, and Sulphide Corporation, Limited (Defendants), Respondents.)

> "5780 Q. Mr. Irvine: Now I am going to ask you one or two questions with regard to the application of what you have been saying to the particular issues in this case. You have given us this selective

action, if I may use such an expression, of bubbles as bubbles. You have told us of the increase of the selective action of these bubbles by the addition of a little acid, and you have pointed out the two functions which you say, in the defendants' process, or a process similar, are performed by the minute quantity of oil introduced; the two functions being the permanency of the froth, for the well recognized scientific reasons you have explained, and the other the extremely minute emulsion which is introduced in that case, but not where there is no oil. Now, I want to ask you, is there necessarily any other function performed in the defendants' process by that small quantity of oil introduced? A. I do not think so.

"5781 Q. It has been suggested—in fact it has been stated very distinctly by some of the witnesses—that even with that extremely minute quantity of oil there must necessarily be a greasing or oiling of all the metal particles. What do you say with regard to that? A. The oil may be in excess and some of the particles may get oiled, but in my opinion, it is quite unessential—entirely and absolutely unessential.

"5782 Q. First of all, with that minute quantity of 1½ lbs. of oil, say to the ton; is it possible to affirm that there is more oil introduced than is necessary for the concentration you have been speaking about? A. I do not think so.

"5783 Q. Mr. Irvine—or filming purposes? I do not think so, because it would be impossible to calculate the entire surface of the enormous number of bubbles.

"5784 Q. You could not affirm in fact, whether there is or is not a surplus of oil. A. I do not think so.

"5785 Q. Unless you can somehow approximately measure the surface of all the multitudinous bubbles in that emulsion? A. Yes.

"5786 Q. Well, it has been further stated that the selective action—that is the picking out by the air bubbles, or gas bubbles, of the metallic particles from the gangue will not take place unless those

metallic particles are greased. What do you say to that? A. I do not agree with that at all.

"5787 Q. You do not agree with that. A. No.

"5788 Q. And that is why you say the greasing is quite unessential to this process. A. Yes, if it occurs.

"5789 Q. Whether it does or does not occur, as I understand you, must be a matter of conjecture? A. Yes."

From this it undoubtedly appears that the "oil in excess" paraphrased by Lord Parmoor from Prof. Pollock's answer to 5781 Q. referred to that modicum or part of the 1½ pounds per ton (employed there by defendant) which under Prof. Pollock's theory might possibly go to and grease "some of the particles" after the air bubbles had all been filmed with oil, and that the difference in the views of the respective experts had to do with the way in which the 1½ pounds of oil per ton of ore functioned in the agitated pulp to bring about the ore concentration obtained, and whether it went primarily to the air bubble or to the metallic particle.

It is not true, therefore (as respondent's brief asserts), that "Prof. Pollock * * * repudiated the idea that there was any virtue in using less than one per cent of oil." On the contrary, he was dealing only with the case of 1½ pounds of oil to the ton of ore (*i. e.*, less than one-tenth of one per cent), and his whole endeavor was to explain how and why so minute a quantity of oil effected concentration in air-agitated pulp.

It is luminously clear that Prof. Pollock did not testify that ore concentration or concentrate froths could be formed by the use of more than one per cent of oil; it is clear that testimony that such concentration could be effected by "from less than 1 per cent to 25 per cent by weight relative to the ore treated" is not in accord with Prof. Pollock's testimony as respondent asserts.

The privy council judgment is considered in brief for petitioners-complainants, pages 35-37.

II. In support of the proposition that "ores that can be floated with less than 1 per cent of oil can be floated with more than 1 per cent." Respondent's brief cites the testimony of Mr. Nutter, Chief Engineer of Minerals Separated, Limited, pages 63 to 66, where he sets out the customary procedure in the treatment of a new ore, and, among other things, speaks of altering the quantity of oil in adjusting to new conditions.

But the alterations in quantity of oil referred to by Mr. Nutter were minute alterations, all well within the limits of the quantity specified in the patent in suit. It is the astonishing fact that, so far as the record here shows, with every ore the world over to which the process has been applied and with all the varying conditions of use, the largest quantity ever used has been 4 pounds to the long ton (*i. e.*, less than 2/10ths of 1 per cent), and that the smallest quantity has been 9/10ths of a pound per long ton of ore (*i. e.*, less than ½ of 1/10th of 1 per cent). See Brief for Petitioners-Complainants, pp. 41 and 42.) The defendant uses 3.2 pounds of oil per ton of oil (*i. e.*, .16 per cent of the oil—less than 2/10th of 1 per cent.) (See Brief for Petitioners-Complainants, p. 88.)

It is such alterations in quantity of oil as these that Mr. Nutter referred to. Respondent's deduction from his testimony is wholly unjustified.

Respondent indulges in the same unwarranted ~~references~~ *inferences* here as in the case of Prof. Pollock.

III. Respondent's brief, in support of the proposition that the process of the patent in suit proceeds when the quantity of oil is more than 1 per cent, cites the evidence of Mr. Higgins, the Metallurgical Engineer for Minerals Separated, Limited, saying, page 47:

> "A. Howard Higgins, Metallurgical Engineer for Minerals Separated, Limited, stated that he produced the characteristic floating froth of concentrates by

means of oil in an amount equal to 3.6 per cent by weight relative to the ore (Transcript, p. 387)."

And the same thing is repeated at page 165, as follows:

> *"Oil—amount of.* The patent in suit recommends a fraction of 1 per cent of oil, but complainant's witness, Higgins, admitted that the same result was obtained upon the Elm Orlu ore with 3.6 per cent of oil * * *".

And on pages 154 and 155, under the heading "Higgins Produced Froth with 3.6 per cent Oil", is a more lengthy statement of the matter.

But reference to the record, page 387, shows that Mr. Higgins' testimony has been misrepresented. The froth produced, he says, did not differ in appearance from the usual agitation froth at a distance of a few feet, "though oily in appearance when closely examined." "These floats were exceedingly dense and occasionally fell down in large masses. The tailings contained some granules, and did not indicate a satisfactory recovery." It also appeared that the recovery was only 50 per cent of the zinc, which means that 50 per cent of the zinc was being thrown away in the tailings—a useless and hopeless result. He further testified: "This plant is not intended for commercial use in treating zinc ores, being only a testing plant."

Mr. Higgins' testimony on this subject has been grossly misrepresented in respondent's brief.

IV. On page 5 of respondent's brief the subhead is as follows:

> "Dr. Liebmann Admits Production of Froth by Use of Large Amounts of Oil."

By this it is sought to convey the impression that Dr. Liebmann admits that the minuteness of the amount of oil prescribed by the patent in suit is negligible and that the same result can be obtained by the use of large amounts of oil.

To sustain this certain portions of the record are referred to and extracts from Dr. Liebmann's testimony are quoted.

It will appear from the record that Dr. Liebmann was being examined with respect to laboratory experiments testified to by the respondent's expert, Dr. Byrnes. Dr. Liebmann testified that he had not seen these experiments and had not repeated them, and his theorizing was based upon the assumptions and statements of Dr. Byrnes. So far from admitting these assumptions and statements of Dr. Byrnes to be true he distinctly qualifies his testimony with an "if." He clearly expresses incredulity that Dr. Byrnes had produced that which he testifies that he had produced, by these experiments, and in the extracts used by the respondent, Dr. Liebmann is theorizing and conjecturing with respect to Dr. Byrnes' assumptions and statements. Since it is perfectly clear that he was not dealing with anything of which he admitted the actual existence, it is entirely improper to state that he "admitted" any fact.

The whole of his testimony on these points shows that he was utterly indifferent to Dr. Byrnes' evidence regarding these experiments, because they did not reproduce or represent anything that was in the prior art or anything that ever had been used, or ever could be used, practically in ore concentration; they were merely laboratory manipulations invented by respondent's expert and of no evidential value.

So far from admitting that a metallurgical result similar to that produced by the process of the patent in suit could be obtained by the use of larger amounts of oil than therein prescribed, he distinctly stated the contrary.

V. Respondent's brief, on pages 46 and 47, refers to certain floating froths or oil magmas produced in the laboratory by the defendant James M. Hyde and by his expert, Dr. Eugene A. Byrnes, with quantities of oil ranging up to 25 per cent of the weight of the ore, as evidencing that the same

result obtained by the process of the patent in suit may also be obtained by the use of such larger quantities of oil.

But these tests do not support the conclusion drawn from them. They never went beyond the laboratory. There is no evidence that they would be of the slightest utility in the mill, or that they could ever be carried out practically in the mill, or that they were in any proper sense metallurgical processes for the concentration of ores.

There is no evidence to indicate that any such processes were ever used with any practical success in the mill. There is affirmative evidence to the contrary. (See pages 196 to 200 of Brief for Petitioners-Complainants.) In a laboratory test an ore pulp, with any quantity of oil, large or small, can be whipped by an egg-beater up into a floating and dirty oil magma, honeycombed with air bubbles, like whipped cream, and carrying a considerable proportion of metal constituents of the ore, but such process would be absolutely useless in the mill for the purpose of concentrating ores.

It is in the highest degree significant that the respondent, instead of demonstrating the practicability in the mill of a process of ore concentration involving the use of notable quantities of oil, as it could perfectly well have done, if any practicable process of that kind existed or were possible, contented itself with the legerdemain of the laboratory, wholly inconsequential even at best in its implications, and stands here and now upon misrepresentation of the testimony of petitioners-complainants' witnesses and of the Privy Council decision.

In determining the fundamental facts on which alone a holding of invention or want of invention in the process of the patent in suit can properly be predicated, the acid test is that of actual use in the mill or capacity for actual use in the mill.

Judged by that test there have been only four processes of ore concentration that are worthy of consideration, namely (to name them in the order of their development),

water concentration, where the values, following the natural law of gravity, go to the bottom; *the Elmore process*, where the values, contrary to gravity and by the buoyancy of oil, go to the top; *the Cattermole process*, where the values, owing to the agglutinating action of oil, go again to the bottom by gravity, and *the process of the patent in suit*, where the values, by the buoyancy of air bubbles and contrary to their own gravity, go again to the top. These are the processes that have concentrated ore in the mill to the benefit of mankind or have had the full potential capacity so to do, and these are the processes that alone call for consideration.

The crude suggestions of Haynes, the impractical processes of Everson, the test-tube theories of the Froment patents achieved nothing for the practical art of ore concentration, while the failure of the Froment description and of Kirby and Schwarz in their paper patents to make any impression whatever upon the practical art or to produce anything that could be used in the mill demonstrates that a problem existed, the solution of which was not obvious.

Classification of Processes.

In order to impart any plausibility whatever to his contention of identity between the process in issue and certain of the prior processes, the respondent finds it necessary to make a misleading classification of the processes involved in discussion in this suit.

On page 8 of his brief he states that

> "All flotation processes fall into one of three distinct classes: (1) The Elmore bulk oil or oil buoyancy flotation process; (2) the surface tension or film or skin flotation process, and (3) the gas-oil flotation process."

And on page 23 he said:

> "No other form of flotation than the three types above described is referred to in this record, and no other form of flotation is known to exist."

Having falsely assumed this premise or basis, it became a matter of great ease to demonstrate, as the respondent then does, that if our process was not an Elmore oil process or a surface tension process, it must be a gas-oil process, similarly with Haynes, Everson, Froment, &c., and, therefore, that our process is Haynes, is Everson, is Froment, &c.

As a matter of fact, with respect to what the respondent includes as flotation processes, there are in addition to those enumerated by the respondent, (4) a lump-kneading procedure, wherein the concentrate is recovered in a lump or lumps, (5) a flowing in suspension of material heavier than water, and (6) a flotation by aëration. The later is the classification under which the invention of the patent in suit falls, and it is absolutely the only one which does fall under that classification, and hence its uniqueness, novelty, and patentability.

Strictly speaking, the first type or class relies wholly upon the bulk of the oil used in the operation and depends upon the lesser specific gravity of the oil and upon its buoyancy or lifting quality when utilized in a mixture of water and ore, constituting an ore pulp. Under this, strictly construed, the Elmore patents would fall.

Under the second group or type there are several patents or disclosures which both the respondent and ourselves agree do not affect any issue involved in this suit, and it is not necessary, therefore, to deal with them.

Under the third head, the gas-oil flotation process, come the Froment patents which antedate the invention of the patent in suit and the Kirby and Schwarz patents, which do not antedate the invention in suit, but the applications for which were filed in the Patent Office before the invention in suit, and the Froment private description (the latter being a hybrid approaching film or skin flotation).

In the procedures disclosed in these documents the flotation was sought to be brought about by the combined buoyancy of oil and of gas or air. Unintentionally the respondent demonstrates the accuracy of this description of these

processes in his brief on page 22, where, under the heading of Gas-Oil Flotation, he says:

"Such floats are permeated with air bubbles."

This is strictly characteristic of gas-oil flotation and is not an accurate or proper description of the process of the patent in suit in which the so-called float is air bubbles and cannot, therefore, with propriety be said to be something else "permeated with air bubbles."

Under the fourth class comes the Haynes British patent and the Everson patent, first method, both of which recover the concentrates in unfloatable pasty lumps.

Under the fifth class comes the Everson patent, second method. In the description of this second method it is plainly stated that the process depends upon making the metalliferous matter lighter than the earthy matter or gangue, and this was to be accomplished by the amount of oil used. She prescribed 17 per cent of oil, which she said would impart buoyancy to hold the valuable matter in suspension in the water above the gangue so that it could be washed or floated away from the gangue by an upcast of water injected against it. There can be no honest inference, from anything said by Everson, that she produced any true flotation—i. e. any flotation upon the top of the water, but only a flowing in suspension in the body of the water of material heavier than water.

The sixth class contains only the patent in suit. In it the very minute quantity of oil used (about one-tenth of one per cent) does away with all possibility of any reliance upon oil buoyancy. The use of the oil is for an entirely different purpose. Its office is to effect the production of very fine air bubbles and to cause the air bubbles to persist and remain constant and firm as they rise through the liquid, and after they have risen through the liquid and to and above the surface of the liquid, carrying with them the metal which has been attracted to them and is attached to them. The

novelty consists in the characteristics of the bubble and its firm and persistent attachment to the metal, which results in its persistence after it has risen above the surface of the water and is resting thereon in a thick layer composed wholly of air bubbles and metal.

In gas-oil flotation processes, as respondent himself contends, there is a magma or pulpy mass composed of gas, oil, and metal partially sustained by the buoyancy of oil and partially sustained by the buoyancy of the gas bubbles which have permeated the float. Since there is too much oil present in all of these processes (except in the petitioners-complainants') the adhesion between the gas bubble and the metal is extremely slight and of no practical value, as contradistinguished from the firm attachment in the process of the patent in suit, which is of great practical value, and hence the gas bubble loses contact with the metal and the latter no longer receives any buoying aid therefrom.

The Cattermole Process.

The Cattermole process is a metal-sinking process which utilizes the adhesive or agglutinating action of oil coatings on metal particles, and is dependent upon that agglutinating factor. It is fully explained in petitioners' brief (pages 122-131). It is also explained in Judge Bradford's opinion (pages 28-31). The two false theories presented in respondent's brief (pages 27-31) are quite completely answered in Judge Bradford's opinion, and that answer is summarized in petitioners' brief (pages 263-266).

It is characteristic of all processes and proposed procedures prior to the invention in suit that the amount of oil used is proportionate to the richness of the ore. With the oil as a buoyant agent or the oil as an agglutinating agent, the amount of oil used was necessarily in proportion to the amount of metal to be buoyed up or the amount of metal to be covered with an adhesive coating of oil. Cattermole, therefore, like Froment in his description, gives his oil pro-

portions relatively to the richness of the ore, but Cattermole knew that he could not treat lean ores except by enrichment or by the addition of material having an affinity for oil.

The process of the patent in suit is unique in that there is no relation between oil proportions and richness of ore (Petitioners' Brief, p. 42). The variations within the range of minute proportion as employed in the concentration of vast quantities of ore has happened in practice to require the smaller quantities for the richer ores. This is because of the new mode of operation characterizing the process in suit, wholly different as it is from anything disclosed in prior documents.

Respondent's brief on pages 30 and 31 quotes testimony of Messrs. Sulman and Chapman describing the procedure in the Cattermole process as evolved in complainant's laboratories in the effort to improve this process and as carried out in the large Cattermole plant installed at Broken Hill, Australia. Here a two-stage agitation was worked out, the first stage of agitation being violent and the second stage of agitation being comparatively gentle, but the quoted testimony of Mr. Chapman includes the statement that, after the first or violent agitation, "the agitated pulp was then passed to a small glass upcast separator where the fine gangue slimes were washed from the pulp, allowing only the oiled metalliferous particles and the coarse gangue to pass to the second stage of the process" (Respondent's Brief, p. 30). Obviously if that first violent agitation had produced the attachment of air bubbles to metallic particles, those air bubbles carrying metallic particles would have gone upward in the upcast separator with the fine gangue slimes and the oiled metalliferous particles would not have sunk against the up-current nor have passed with the coarse gangue to the second stage of the process. Respondent's false theory that in this procedure the violent agitation caused the attachment of air bubbles to metallic particles is disproved by the very evidence cited to support

it. The metal particles in the Cattermole process were so heavily oiled (as compared with the attenuated films of oil on the metal particles produced in the process in suit) that although the agitation in the cone-mixer or Gabbett caused great quantities of air to be drawn into the pulp and beaten up into bubbles, the metal particles rejected these bubbles and they escaped from the pulp and so far as we know performed no function whatsoever. Later it was discovered that the same kind of agitation in the same cone-mixer or Gabbett, with the same fine pulverization of the ore and the same presence of great quantities of slime in the ore (for Cattermole like the process in suit utilized and concentrated slimes), and the same heating of the pulp such as had been evolved as an improvement upon the disclosures of the Cattermole patents, and the same presence of acid in the pulp, produced, when the oil proportion was reduced to one-tenth of one per cent, the process of the patent in suit. The statement, therefore, in the patent in suit that the ore pulp "is briskly agitated in a cone-mixer or the like, as in the processes previously cited" (*i. e.*, the Cattermole process as disclosed in the Cattermole patents) is exactly true, and respondent's ascription of error to this statement (respondent's Brief, p. 31) is unfounded. Brisk or violent agitation in a cone-mixer or Gabbett is the only kind of agitation in a cone-mixer or Gabbett which is described in the Cattermole patents, and that kind of agitation, with a reduction of oil to about one-tenth of one per cent on the ore, effects the new mode of operation characterizing the process in suit.

Patent in Suit.

Although the process in suit can be carried on with the same kind of agitation as characterized the Cattermole process disclosed in the Cattermole patents, it is not true at all that this kind of agitation characterizes anything else in

prior disclosures. Further, the introduction of air in an ore pulp does not produce the new mode of operation of the process in suit unless the oil is present in the minute proportions characterizing that process. Except Elmore, wherein as respondent's brief admits, aëration was avoided (pages 11-20), there was no prior process of ore concentration practiced in the mill wherein oil was used. As to the disclosures of prior documents, which never got beyond the paper on which they were written, or at most the laboratories in which they were born and died, a careful study of each document shows that where aëration or gasification was proposed, it was not in the pulp conditioned by the presence of the minute amount of oil characterizing the process in suit, but by a grossly larger amount of oil, and was not produced by agitation, but by chemical generation or by introduction through pipes into the pulp. With this explanation it may be seen that the statements in this regard, on page 33 of respondent's brief, are based on false premises.

As to the baffles which are an essential part of the cone-mixer or gabbett, when it is in cylindrical form, the facts as proved are explained in petitioners' brief, pages 43, 44, and pages 109-111.

Respondent's brief, at page 35, says that there is only one brief reference to air as cause of flotation in the patent in suit. Obviously the one statement quoted describing the operation would be sufficient, but froth is referred to from the beginning to the end of the patent.

Haynes British Patent.

Respondent's brief misrepresents this patent at pages 37, 38, and 102-105. Its disclosures are accurately explained in petitioners' brief, pages 93-96, in harmony with Judge Bradford's conclusions (Judge Bradford's opinion, page 23, 24) and those of the Privy Council quoted by Judge Bradford (R., p. 749).

Everson Patent.

This patent discloses two methods. The first method starts with a stiff mass produced by mixing the ore with a material made by compounding sulphuric acid and cotton-seed oil, the oil being in the proportion of five per cent of the ore. This mass is kneaded in water, and thereby the gangue is washed out, and the specification says that

> "The concentrated mineral will accumulate in a pasty mass or lump or lumps and will contain the metallic portion of the ore" (R., p. 581).

Respondent's brief, in describing this first method (p. 107), omits the statement that the concentrate is recovered in a "lump or lumps," and then says that the concentrate obviously could not be recovered by its sinking or settlement. In fact, in the wash-basin operation described by Everson, it is recovered adhering to the fingers of the operator, and on a larger scale the lump or lumps obviously would not be expected to float.

Everson's second method uses more oil, about seventeen or eighteen per cent of the ore, and this produces a more liquid mass of concentrate and oil, which is flowed off in accordance with the principles of wet concentration of ores, the mixture of metal and oil being lighter than the sand or gangue and heavier than the water, and being carried away by a current which will not carry away the sand or gangue.

This is all of the Everson disclosure. It is fully explained in petitioners' brief (pages 98-105). The interpretation of Everson's patent by the House of Lords is explained in petitioners' brief (pages 26-31). It is fully considered in Judge Bradford's opinion (pages 26 and 27), and that consideration summarized in petitioners' brief (pages 261, 262).

Fryer Hill and Criley-Everson Publications.

These publications come within the rule of Cohn *vs.* U. S. Corset Co. (93 U. S., 366, 370) as stated in the quotation at page 210 of petitioners' brief. They are wholly insufficient for the carrying on of any procedure. Defendant's expert undoubtedly rejected the later of them as insufficient, since he admitted that he knew of it (R., p. 125, x q. 88), and yet failed to refer to it in his testimony attacking the novelty of the patent in suit. The interpretations placed upon these publications in respondent's brief are wholly those of counsel. The only testimony in the record in regard to these publications is to the effect that the disclosures are insufficient, as appears in petitioners' brief (pp. 105-108). The characterization of the Criley-Everson publication by the Privy Council is there quoted (R., pp. 106, 107), and is more fully considered earlier in petitioners' brief (p. 28). Both publications were quite summarily dismissed from consideration by Judge Bradford in his opinion (p. 27).

Froment Patents.

In dealing with Froment's "thin layer of ordinary oil" respondent's brief ignored the fact that Froment's invention is stated in his British patent to be "a modification of what is known as the oil process of ore concentration," and the evidence that the only process that could be thus referred to was the Elmore oil-buoyancy flotation process and that Froment was familiar with that process, which had been installed at the mines where he was engineer. It ignores the fact that defendant's expert interprets this description as meaning olive oil, cotton-seed oil, or oleic acid, and that the evidence shows that it requires twelve and a half per cent of such oils to form the thinnest possible layer that could have been described by Froment. In respondent's

brief, on page 41, line 5, it is stated that "olive oil" in such a thin layer is within a range of proportions the maximum of which is 2.27 per cent, but an examination of the testimony referred to shows that the item referred to was a mixture of the very thin oil, turpentine, and olive oil. Again, it is said on the same page, second paragraph, that Mr. Ballantyne's determination of the thin layer is five per cent on the weight of the ore, but an examination of the testimony referred to shows that Mr. Ballantyne merely said "I find that the thin layer of oil amounts to not less than about 5 per cent on the weight of the ore (that is 112 pounds of oil per ton of ore) (R., p. 236). So also respondent's brief appears to forget the Froment Italian patent with its direction that the mixture in the test tube is to be "agitated for a second" (R., p. 473). These matters are fully treated in petitioners' brief (pages 146-162), and in Judge Bradford's opinion (pages 31-33).

The elaborate effort in respondent's brief to show that this Froment procedure with its minimum of 11½ per cent of oil is the same as that of the process in suit with its minute oil proportion of one-tenth of one per cent. in the exceptional instance where the presence of a considerable amount of calcite in an ore compelled the wasteful consumption of sulphuric acid (which was decomposed by the calcite immediately on contact therewith and had to be added in such quantity that some portion of it would survive and act physically in the process) is perhaps best answered in Judge Bourquin's opinion wherein he contrasts the Froment patents and the Froment description with the process in suit (R., pp. 21-24), most of which is quoted in petitioners' brief (pp. 167-169). An interesting series of experiments, however, showing how the ~~process in suit~~ carbon disulfide is driven out of a pulp in the practical operations under the process in suit is described by Mr. Chapman and was not referred to in petitioners' brief. Here the ore contained calcite in moderate amount and sulphuric acid had to be used for its physical action and was, therefore, to some extent

wastefully consumed in the useless and inevitable chemical action, resulting from its contact with calcite. The froth in a succession of spitzkastens was analyzed as to its gas contents and the first spitzkasten had 3 per cent carbon dioxide mixed with the air, the second 1.6 per cent, the third 1 per cent, the fourth 0.7 per cent. Unfortunately this used up the sampling glasses and the disappearing factor of carbon dioxide in the fifth and sixth spitzkastens was not determined (R., p. 392). The evidence is quite clear that the gas carbon dioxide is a harmless diluent of the air to the extent that it has ever appeared in the process in suit and that the successive agitations characterizing all practical work under the patent in suit drive it out of the pulp whenever its formation in the pulp occurs because it cannot be avoided.

Froment Description.

The disclosure of this private document is hopelessly blended with the disclosure of Froment's patents in respondent's brief. This is particularly true in the deadly parallel columns. The principal fault of the discussion of the Froment description is that it ignores Froment's very clear and distinct statement that he removes all slimes from his ore before he attempts to treat it. The best summary statement of the essential facts as to this Froment description is found in Judge Bradford's opinion (pp. 33, 34). Judge Bradford had before him the same evidence as is before this court relative to the history of the efforts of Sulman, Picard, and Ballot to make something of value out of all that Froment disclosed both in his patents and in his description, and says:

> "The fact that they did not utilize it affords the strongest evidence that the Froment description did not suggest a process in which the minute quantity of oil requires by the first patent in suit could be successfully used in ore concentration."

This subject is explained in petitioners' brief (pp. 162-171).

Glogner Patent.

This is the only document prior to the invention of the process in suit wherein the word "froth" appears. That the procedure here disclosed is one of oil-buoyancy flotation is undoubted, and the matter is considered in petitioners' brief (pp. 119-121), but attention was not there called to the fact that Glogner sprinkles his float with water "by means of a rose" (the familiar watering-pot sprinkling nozzle), which is the best possible means of destroying any little bubbles of froth which might possibly have survived to the point where the float is sprinkled with water. As Dr. Liebmann says:

> "If the inventor had contemplated a froth process, he surely wouldn't have destroyed the object of such an invention by sprinkling water on the surface of the oil" (R., p. 261).

Schwarz Patent 807,503.

This, of course, was not a patent, but only an application in the Patent Office, at the time when the process in suit was discovered and invented. It is considered in petitioners' brief (pp. 171-177). Judge Bradford comments upon the fact that this and another Schwarz patent, No. 807,502, were offered in evidence by the defendant, but not explained in defendant's testimony, nor made the basis of any argument in behalf of defendant (Judge Bradford's Opinion, p. 25). Nevertheless Judge Bradford takes the precaution of carefully considering these patents and says:

> "There is, I think, no evidence or legitimate inference to warrant the conclusion that either of these patents can affect the validity of the first patent in suit."

Judge Bradford's consideration of these patents is summarized in petitioners' brief, pages 268-269.

Kirby Patents.

The best summary statement of the disclosures of these patents appears in Judge Bradford's opinion (pp. 24, 25). They are very fully considered in petitioners' brief (pp. 177-191). The principal vice of respondent's brief in its treatment of the Kirby-process patent is the multilation of a sentence in quotation (p. 178) so as to make the first part of the sentence appear to describe the main process, and the concluding part of the sentence appear to describe a supplementary process, whereas, in fact, the description is of one continuous procedure, and not of a main operation and "a supplementary or aditional operation," as stated in respondent's brief.

Potter Patent.

Respondent's Brief quotes from the Privy Council judgment the statement that the respondents there alleged that their process could work with practical utility without any admixture of oil (p. 84), and later asserts that in contradiction thereof the petitioners here urge that oil must be used in their process (p. 91), and later again quotes this statement from the Privy Council judgment and says that apparently the position was well taken since the Potter patent fulfills this condition, and then proceeds to explain respondent's theory as to the disclosure of the Potter patent (pp. 96-98). These statements involve suppression of the well known fact that a few years after the discovery of the process in suit, the further astonishing discovery was made that certain soluble substances were capable of acting as the minute amount of insoluble oils act in the process here in suit in modifying bubble and froth formation and action so that ores may be concentrated by air bubble flotation. The patent for this later discovery is not in evidence herein, but fortunately is referred to and fully described in Judge Bradford's Opinion

(pages 48-50). It is the soluble frothing agents patent No. 962678 of June 28, 1910, to Sulman, Greenway and Higgins, and it was held by Judge Bradford to be valid and infringed in the case before him.

The Potter Patent totally lacks a frothing agent of any character, which accounts for the fact, testified to by respondent's expert, that when he carried out this process in a test tube the metal "floated for a brief period only and then again subsided to the bottom of the tube" (R. p. 104 expt. 4).

This quotation appears in full in Petitioners' Brief (p. 118) and the Potter patent is fully discussed at pages 116-119.

Other Flotation Processes.

Respondent's brief, on pages 54 and 55, refers to the alleged use of other "processes" than that of Minerals Separation, Limited, referring to the testimony of Chapman and H. C. Hoover.

Mr. Chapman refers to a "modified" Potter process as in operation during his visit to Australia. What the process was or how it compared with the Potter patent in evidence, or how it had been modified, we are left to conjecture. As to the De Bavay and Delprat processes, Mr. Chapman merely testifies that he tried to see them but failed and there is no testimony as to what they were. All of these processes may have been the Minerals Separation process secretly practiced and disguised by another name. And so far as the evidence goes the reference may be to a date subsequent to the making of the invention in issue.

Mr. Hoover, a witness intensely hostile to Minerals Separation, Limited, testified that he had been for many years managing director of the Zinc Corporation, that the Potter method proved a failure there; that in 1907 the Minerals Separation process was installed and also proved a failure; that a certain Elmore vacuum process was then adopted, but ultimately some time in 1910 was discarded

and the process of Minerals Separation, Limited, was re-adopted.

The Zinc Corporation at the time Hoover gave his testimony in August, 1912, was paying Minerals Separation, Limited, 2 shillings and 6pence per ton, on an annual production roughly of 90,000 tons of concentrate (Record, p. 172). This figures out about $56,000 a year.

This witness admitted (Record, page 173 at bottom, and 174 at top) that the vacuum method had been applied to selected material "of the simplest metallurgical character amongst the company's holdings and that the remaining material was of such a character that it could not have been treated profitably" by that Elmore vacuum process.

This witness also states (p. 173, Ex. Q. 33), that large accumulations of tailings at Broken Hill, Australia, had resulted from the fact that over a period of many years the Broken Hill Mines were unable to profitably extract the zinc and there had accumulated some 10,000,000 or 12,000,000 tons of mill residues containing the major portion of the original zinc content.

Originality of Invention.

Under this heading respondent's brief, on pages 193 to 199, argues that if a new invention has been made it is the invention of Mr. Higgins, and not the invention of Messrs. Sulman, Picard & Ballot.

But Mr. Higgins was merely the laboratory operator acting under the instructions of Messrs. Sulman, Picard & Ballot, and reporting to them. He was merely their hands to do and their eyes to see. There is absolutely no evidence that he suggested anything. (See Petitioners-Complainants' Brief, pp. 227-229.)

Respondent's brief calls attention to the fact that the instructions issued to Mr. Higgins called for observations and determinations of several varying factors upon granulation.

The instructions, however, were to press the observations and determinations to the limit, no matter what happened, and they were, in fact, broader than merely the investigating of granulation. Thus Mr. Sulman testified (Record, p. 130, side paging 259):

> "At some date a week or two prior to the discovery of the air agitation froth, Mr. Ballot, Mr. Picard, and myself had been in close consultation as to a number of factors which we considered required final investigating and quantifying. They concerned mainly the operation of the Cattermole process, but we also had in view the clearing up of a number of loose-end observations noticed in previous developments of oil concentration work. * * * The carrying out of these final investigations was done under the immediate supervision of one or other of us throughout the whole of them."

See also *Ballantyne* as quoted in our brief, page 68 at bottom and page 69 at bottom.

Respondent's brief says, on page 196, that the "observation" which "surprised and elated" his employers "was the act of Higgins performed independently of the alleged instructions." But this is simply contrary to the evidence. Mr. Higgins was on the witness stand as respondent's witness and testified that everything he did was done in pursuance of the instructions of Sulman, Picard & Ballot, and respondent did not dare ask him whether he was himself the inventor or one of the inventors.

Respondent's brief also says on page 196 that Mr. Ballot testified in another suit:

> "That his name appeared upon certain British patents because he was chairman of Minerals Separated, Limited, and was specially directed by the directors of that company to have his name added as a matter of extra precaution for the company."

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The implication clearly intended is that Mr. Ballot so appended his name to the patent here in suit and only so.

But this is a distinctly false implication, as appears in the record, at page 166, Q.'s 110 and 111, where Mr. Ballot expressly states:

> "That was not the reason why my name appeared in the patent in suit or the corresponding British patent."

And in answer to Q. 110 he said:

> "As a matter of fact I do not believe that my name has appeared in any cases in the invention of which I did not participate."

Mr. Ballantyne, who, as patent agent, prepared the application for the patent in suit, very fully explains these matters and states his clear recollection of "taking steps to insure that the application should be in the names of the actual inventors" (R., pp. 228, 229, Q. 27).

All of the authorities cited on pages 197 to 199 of respondent's brief are distinguished from the case at bar by the circumstance that in them the outsider made the suggestions substantially constituting the invention. In the case at bar Mr. Higgins made no suggestions whatever.

The Question of Invention.

Respondent's brief on page 16 cites authorities of this and other courts under the caption, "Authorities That Change of Degree Without New Result is Not Invention," and the authorities cited go only to that extent. They are one and all distinguished from the case at bar, in that in the case at bar the diminution in the quantity of oil employed introduces a new principle of action and produces a new metallurgical result. The new principle of action utilizes a characteristic of oil never before utilized in any metallurgical process and not theretofore known to exist. And the new

metallurgical result is of such character and importance that it has revolutionized the art, superseding prior processes, and has rendered accessible the values in dumps and residues weighing millions of tons that were theretofore unrecoverable by any known process. Values to the extent of millions of dollars have been in effect created by being made recoverable.

Under these circumstances the existence of invention is simply not debatable.

That a new metallurgical result of momentous and revolutionary character has been achieved is manifest by the fact testimony in this case which was referred to by Judge Bourquin (R., p. 21), and in Judge Bradford's decision in the Miami case on testimony given at a later date, and after a prodigous intervening development in this country (see page 1 of his opinion); and it is significantly indicated also by the circumstance that the right to use the process has been worth fighting for twice in Great Britain, one case going to the House of Lords, in 1909, and the other case coming up from the Supreme Court of New South Wales and going to the Privy Council, in 1914; and it is indicated also by the adoption and use of the process by defendant here, and by others, such as the Miami Copper Company, and by the character of this and other litigation in defense of continued use of the process. Mere economy of a few thousand dollars a year in oil does not explain these facts. They are explained by the $9,000,000 in metallic values that this process recovered from the dumps of Australia, and by the $17,000,000 a year in metallic values added to the resources of mankind by the application of the process to the principal porphyry copper mines of this country, as proved before Judge Bradford in 1915 (see his opinion, page 18).

The Circuit Court of Appeals in the case at bar agreed with Judge Bourquin's finding of utility on the testimony here, and does not assume to find that that utility consisted merely in a saving of oil.

That the process in suit introduces a new principle of

action utilizing a characteristic of oil never before utilized in any metallurgical process, and not known to exist prior to the discovery and invention in issue, is proved to the point of demonstration by the history of the invention, treated at pages 59 to 83 of our brief, and particularly the history of the making of the discovery itself, which is treated at pages 67 to 78 of our brief. Contemporaneous documents and the sworn testimony of six witnesses, Sulman, Picard, Ballot, Higgins, Chapman and Ballantyne, establish the facts—facts substantially ignored in respondent's brief and in the opinion of the Circuit Court of Appeals in this case. Five of these men were distinguished metallurgists skilled in this art. Their efforts and energies for a period of two and one-half years preceding the making of the invention in issue had been directed to the problem of concentrating the ore residues found in the dumps at Broken Hill, Australia, to the extent of 10,000,000 to 12,000,000 tons, one-third of which dumps was metallic zinc, lead and silver, but to which, owing to the almost identical specific gravity of the metal and the particular gangue with which it was associated in that ore, water concentration processes were inapplicable and useless. These metallurgists, with all the information that Froment could give them, publicly and privately, had failed to make his process work and had abandoned it about a year before the making of the invention in issue, and had scrapped the Froment apparatus. They had also early rejected the Elmore bulk oil process, with its reliance upon oil buoyancy to float metal, and had centered their efforts on the Cattermole process, wherein the agglutinating action of oil is utilized and reliance is placed upon the greater tendency of large granules (as of metal) to sink than that of small unagglutinated particles (as of gangue); the values in this case being sent to the bottom. In this quest the inventors stumbled upon the conditions characterizing the process in suit, including the minuteness in the quantity of oil employed, and were astonished both at the values recovered and at the manner of recovery, for the values went to the top instead of going

to the bottom; and they recognized at once that a new quality in oil had been discovered, that a new principle of action had been invoked, and that a new metallurgical result had been achieved. This instant and astonished recognition, the anxious and careful repetition of the procedure time after time in order to make sure that it was not a freak operation, and the immediate abandonment of all interest and effort in the Cattermole process, and exclusive adoption of the new flotation process, both in the laboratory in London and in the commercial plant in Australia, that Chapman was at that very moment perfecting and putting into operation for the Cattermole process—all this appears in the contemporaneous documentary evidence, as well as the inventors' intelligent appreciation of the fact that it was neither the buoyancy of the oil, as in Elmore, that caused the flotation, nor any agglutinating action of the oil, as in Cattermole, nor any action of carbon-dioxide gas chemically formed *in situ*, as in Froment, but solely the buoyancy of air bubbles, and that the oil present in the astonishingly minute quantity at which the new operation had developed merely so conditioned the operation—so contaminated the pulp—that the agitation produced just the character of minute and persistent air bubbles necessary to achieve the flotation and concentration.

It is impossible to read this history without reaching the settled conviction that what these men did was not obvious or a result predictable beforehand, and that they achieved not a mere reduction of the quantity of oil in an old process, but a fundamentally and conspicuously new process. Their surprise at their own achievement is not found merely in their depositions taken in this case, but is found in the contemporaneous documents, of a date long anterior to this controversy.

Thus Mr. Ballot wrote to Australia on March 10th, 1905 (to Mr. Courtney, Consulting Engineer for Minerals Separation there at that time; R., p. 159, below the middle):

> "I am pleased to tell you that during the week we have made some very important discoveries which will, I think, almost revolutionize our processes by way of simplifying and cheapening the same. * * * I may mention for your private information that we do not use more than .1 per cent of Oleic acid per ton of ore, and although we have not assays out that the recoveries will be very satisfactory."

Mr. Higgins on March 16th, 1905, making a formal report in writing of what had been orally reported from day to day (R., p. 448), says:

> "The effect of diminishing the percentage of Oleic acid is to alter the type of oiling; the higher percentages producing granules, and the lower ones froth. * * * 0.62 per cent Oleic acid on the mineral is insufficient to form any granules and nearly the whole of the mineral comes to the surface, on stopping the cone, as froth."

And the "Details of Experiments," given immediately below on the same page, show that at 0.32 per cent of Oleic acid on the ore the float was "vastly increased," and at 0.10 per cent the float was again "vastly increased" even over that.

Mr. Ballot on March 17th, 1905 (R., p. 159, at bottom), wrote again to Mr. Courtney, enclosing Higgins' report, and saying (p. 160, line 4):

> "I think this discovery very important, indeed. * * * As I wrote you in my last, we are having our patents thoroughly overhauled in view of these developments, and it will therefore be necessary to keep this as confidential as possible until we know the result."

Thus the patentable nature of the discovery and invention that had been made was also at once recognized.

On May 3d, 1905, Messrs. Sulman and Picard made a

detailed summary of the whole matter to Mr. Ballot, as chairman of the company, saying (R., p. 450):

> "We beg to hand you herewith a statement of the new method of oil concentration which we have been engaged in investigating and working out in detail, for the purpose of your forwarding it to Mr. Courtney and his staff in Australia.
>
> "It will be best to start with a short statement on the principle on which the process depends."

After giving details the report proceeds:

> "This important discovery naturally suggests an economical method for the recovery of Broken Hill mineral quite different from any employed by you previously. The froth produced is not due to any action of the acid circuit upon traces of calcite present in the ore; *i. e.,* not to the liberation of any gas in the charge by means of the dilute acid employed in the circuit.
>
> "It has been located, on the contrary, to the air introduced by the Gabbett cone during agitation, the air attaching itself to the oiled mineral slimes and to a large proportion of the coarse mineral particles, although both of these materials can only be coated with an infinitesimal amount of oil; *i. e.,* Oleic acid."

Judge Bradford refers to this history as persuasive on the question of invention (see his opinion, page 10, and our brief, pages 254 to 258).

The proposition that the patentees in suit had achieved a new process involving a new principle of action in oil, finds support also in the judgment of the House of Lords, in 1909, and of the Privy Council, in 1914, discussed in our brief on pages 25 to 38. For the holdings of non-infringement of the A. S. Elmore patent by the process here in issue proceeded in each case upon the finding of novelty in the process here in issue both in procedure and in principle of action.

Thus, in the House of Lords, Lord Shaw characterized the process here in issue as

> "A new method of separation."
> (Our brief, p. 34.)

And, in speaking of Minerals Separation process, he adds:

> "They rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid."

And in the Privy Council, Lord Parmoor, calling attention to the varying theories of the experts as to the principle of action of the process here in issue, said (see our brief, p. 36):

> "Their lordships accept the evidence of Prof. Pollock, * * * summarized as follows: * * * He [Pollock] states that he does not think that the small quantity of oil introduced in the defendant's process necessarily performs any other function than permanency in the froth and extremely minute emulsion."

The proposition that a new principle of action is involved in the process in issue finds confirmation also in the fact that where every other oil process that is cited by respondent, as substantially identical with and as anticipating the process in suit, failed in the mill, if ever tried there, failed in practice, failed to make any impression upon the practical art, the process in issue succeeded in the mill, succeeded in practice, revolutionized the art. This inevitably implies substantial difference. And, especially so if we assume, as we must assume, that each and every inventor of the prior art prescribed for his process the minimum quantity of oil that would carry out his principle of action and achieve his result.

Significant evidence that a new principle of action is involved is found also in the related facts that the process in issue solves the slimes problem and has revolutionized the character of grinding employed. Slimes are the impalpable dust (produced more or less in all grinding however coarse) in suspension in water. No prior process except Cattermole's recovered the values from the slimes. The slimes

everywhere ran to the dump. The values in them were lost. It was one of the chief merits of the Cattermole process that it agglutinated even the finest metallic particles into large granules that would sink and so recovered the values from the slimes. The process in suit not only recovers the values from the slimes, but acts better with slime particles present than with larger particles and seems even to require the presence of some slimes in the pulp, a fact which was at once recognized (Rec., p. 451, 452). And the practical effect of the introduction of the process in suit upon grinding has been to make fine grinding no longer a bugbear, but the rule where previously it had to be avoided.

The proposition that invention was involved and required in the process in issue finds support also in the fact that the principle of action of that process is not completely understood even to this day. We do not yet know just why it is that the minute amount of oil employed in the process in issue under the conditions in which it is there employed does the work, or how it does the work, that we see done. But the procedure required—*i. e.*, the steps that must be taken—are known and are indefinitely repeatable; and the ore concentration that in fact results is sufficiently tangible so that the art can work the process and get the result. Where the man skilled in the art cannot explain the principle of action of a process after it is known and put into use, how can it be possible that the process was theretofore obvious?

A question of invention arose in the Privy Council case (Ore Concentration Company, Limited, *vs.* Sulphide Corporation, Limited), and we cite that decision here as an authoritative exposition of English law on the subject of invention and what constitutes invention (R., p. 753, at bottom):

> "The question whether the discovery claimed in the patent [the A. S. Elmore patent there in suit] constitutes invention, such as will support the validity of a patent grant, is a question of fact to be determined in each case upon all the relevant circum-

> stances. In the present case there is no substantial difficulty. There is clearly no anticipation, nor was this case put forward in argument. The discovery of the patentee was at the date of the patent both novel and useful, resulting in a new process of commercial importance and value. If a discovery complies with these tests, there is invention sufficient to give validity to a patent grant, and it does not matter whether the discovery was the result of long research or of a sudden thought. The patentee gives no theory of the action on which his invention depends, and he is under no obligation to do so. It is said that the theory is not understood. In such a case prevision is not possible, and it is difficult to negative novelty unless the actual invention claimed has been either disclosed or used prior to the publication of the patent."

In the case at bar there is the same novelty in the sense that the actual invention claimed is not found either disclosed or used in the prior art—that is to say, there is no disclosure or use in the prior art of a process proceeding by the use of less than 1 per cent of oil—and this is conceded, and was held to be the fact, not only by Judge Bourquin, but by the Circuit Court of Appeals itself. And in the case at bar there is the same utility, in the sense that a new process of commercial importance and value has been achieved, and this was held to be the fact not only by Judge Bourquin, but by the Circuit Court of Appeals. And in the case at bar the theory of the action of the process is not understood, so that in the same way prevision was not possible. And accordingly, as was said by the Privy Council, it would be difficult to negative novelty and, we would add, difficult to prove or to hold obviousness, in the absence of any disclosure in the prior art of the actual and exact invention claimed, especially at the insistence of a defendant who is making use of the actual and exact invention claimed.

In addition, in the case at bar the fact that a new property of oil has been discovered, and a new principle of action

utilized, is demonstrated and non-obviousness is affirmatively proved.

It is difficult to follow the contentions of the respondent and impossible to determine what his position is. He commits himself with apparent finality or definiteness to the proposition that our invention lacks novelty and patentability, because the selective affinity of oil for metal was old, the use of oil in conjunction with ore pulp to produce concentration was old, and all we did was to lessen the degree of oil and thereby effect an economical procedure. With like apparent finality or definiteness he commits himself to approval of the judgment of the Privy Council. This decision with absolute clearness determines that the selective affinity of oil for metal was old; that the use of oil in conjunction with ore pulp to produce concentration was old, but that our process of using oil in conjunction with ore pulp to produce concentration was new. When his arguments are analyzed he must abandon one or the other of the two positions he has assumed. He does not better his position when he falls back on his second line, because in the very act of falling back he must abandon what it was imperative for him to retain. He must, to succeed, maintain the proposition that after the first discovery of the possibility of ore concentration by the conjunction of oil and ore pulp any and all subsequent oil processes are mere variations of degree and therefore not invention. By his own admission of the effect of the judgment of the Privy Council on this subject, he cannot successfully sustain that proposition. He is thus forced to concede that it is not a mere question of the use of known elements in combination to produce concentration, but the real question in each case is the mode of operation—that is, the principles evoked by each process and the metallurgical result obtained thereby.

It then becomes incumbent on him to point out that the mode of operation—that is, the principles evoked by the invention of the patent in suit—were disclosed in the art prior to complainant's disclosure thereof.

This he fails to do and cannot do, because it is not the fact. Driven to concede that if the complainant's process discloses a novel mode of operation evoking principles not theretofore evoked in previous disclosures that it is patentable, his denial of the basis of patentability thereof is an empty assertion lacking any evidence to sustain it.

The complainant's discovery does not consist in determining how the mode of operation of previous processes could be effected with a lesser degree of oil. It did not show how the principles evoked by previous methods could be made operative with less oil than such methods prescribed.

It consisted in a distinct and novel mode of operation—in the evoking of distinct and hitherto unused principles of action which could be brought into being and made operative only by the use of the minute amount of oil prescribed and by the method set forth.

The new thing in the complainant's discovery was the new principles first brought into use by his process.

They are no less novel because produced by using different quantities of previously used elements.

He discovered a novel principle of ore concentration and described the method of evoking it and one of the incidents is the use of oil in a minute quantity. The discoverable invention is of the principles evoked—the mode of operation—and one of its incidents is the respective quantities of the necessary factors or elements required to produce it.

The question of the quantity of such factors cannot with any propriety be treated as a matter of degree, because that is only proper where comparison is possible. Comparison cannot be made between things which are by their nature incomparable. That is the situation in this case. The principles evoked by the complainant to produce his metallurgical result are so radically different from those relied upon in the prior disclosures that you cannot properly speak of the degree of the factors used, because such factors were not used for a common or like purpose. In other words, there is no

common denominator and hence no basis for dealing with comparative degrees.

Discovery, invention, and patentability are manifest.

Respectfully submitted,

HENRY D. WILLIAMS,
WM. HOUSTON KENYON,
LINDLEY M. GARRISON,
FREDERIC D. McKENNEY,
JOHN H. MILLER,
ODELL W. McCONNELL,
Counsel for Petitioners.

(32292)

Supreme Court of the United States, October Term, 1916.

No. 46.

MINERALS SEPARATION, LTD., and MINERALS SEPARATION AMERICAN SYNDICATE, LTD., Petitioners-Complainants,

vs.

JAMES M. HYDE, Respondent-Defendant.

It is hereby stipulated that the following corrections be made in the transcript of record:

Index, page iv, line 17: Change "patent" to *plant,* so that lines 16 and 17 will read:

"Complainants Exhibit Photograph Australian Cattermole *plant*"

Page 21, line 21: Change last word "firm" to *fine*

Page 21, line 39: Insert *a* between "of" and "balloon"

Page 21, last line: Insert *a* between "of" and "proportion"

Page 23, line 32: Change "is" to *are,* so that the line will read:

"only, in the majority of cases, *are* good, and the best results obtained"

Page 42, line 34: Change "and" to *to* between "102" and "105"

Page 103, line 41 (9 from bottom): Change last word "held" to *half*

Page 196, line 4: Change "to" to *of* before "1½ lbs. of oil per ton of ore"

Page 197, line 13: Insert *as* between "used" and "a minimum equal"

Page 222, line 26: Change "any" to *an* before "oily mass with water"

Page 288, line 14, following heading "Example 2" change "from" to *form* between "concentration" and "cakes".

Page 294, line 3 following heading "Process Revealed by Instructions" change "of" to *for* between "per minute" and "about ten minutes"

Page 294, line 6 from bottom: Change "to" to *in* between "resulting" and "oiled"

Page 314, line 13: Insert the decimal point before "5% of sulphuric acid"

Page 326, line 28: Change "777,247" to *777,274*

Page 373, line 6 from bottom: Change "off" to *of* between "oil process" and "ore concentration"

Page 436, line 3: Change "ersidues" to *residues*

Page 569, following the star page note 1083, the black line or rule after passing above the words "Cancelled June 15/06" should pass downward and then below the words

"fraction of 1% of oil on the ore, agitating the mixture to cause the oil coated mineral to form a froth, and separating the froth from the remainer of the mixture."

The meaningless numeral 18 on the line below that commencing with star page 1083, should be erased.

To make perfectly clear what matter enclosed between rules was erased by amendment, a diagonal line should be drawn across the print from the top rule on the page to the second rule on the page and from the third rule on the page in its amended position down to the fourth rule on the page. A page corrected as above is hereto annexed.

Canceled June 29/06.

D[553]. 12. The process of concentrating powdered ore which consists in separating the minerals from gangue by coating the minerals with oil in water containing a fraction of 1% of oil on the ore, and recovering the oil coated minerals.

[Matter enclosed between rules erased in copy.]

12 [12].* The process of concentrating powdered ore which consists in separating the minerals from gangue by coating
1083 the minerals with oil in water containing a

Canceled June 15/06.

fraction of 1% of oil on the ore, agitating the mixture to cause the oil coated mineral to form a froth, and separating the froth from the remainder of the mixture.

14. The herein described process of concentrating ores which consists in mixing powdered ores with water, adding a small proportion of oily liquid having a preferential affinity for metalliferous matter, (amounting to a fraction of 1% on the ore) agitating the mixture until part of the oil-coated mineral matter forms into a froth, removing the froth, subjecting the remaining pulp to the action of a compressed gas in a closed chamber, and thereafter relieving the pressure whereby gaseous bubbles are liberated in the pulp and raise the oil-coated mineral particles to the surface.

[Matter enclosed between rules erased in copy.]

Insert B, Apr. 24/06.>

Respectfully submitted,

KNIGHT BROS., *Attorneys.*

Wash., D. C., April 14, 1906.

KINGDOM OF GREAT BRITAIN AND IRELAND,
City of London, England, ss:

Henry Livingstone Sulman, Hugh Fitzalis Kirkpatrick-Picard, & John Ballot, being sworn, depose and say that they are subjects of the King of England, and residents of London, England, that they verily believe themselves to be the original, first and joint inventors of the improvement in Ore Concentration described and claimed in

[* Words and figures enclosed in brackets erased in copy.]

Page 582, line 3: Change "through" to *thorough*
Page 582, line 36: Change first "of" on this line to *or*, so that the line will read:

"and oils by one *or* the other of which practical results may be ob-"

Page 688, line 11: Change "salution" to *solution*
Page 707, line 7 from bottom: Change "oiling" to *oil*, so that the line will read:

"of a modification of what is known as the oil process of ore"

Page 746, line 15: Change "demonstration" to *demonstrations*
It is further stipulated that the following correction shall be made in Petitioners' brief:
Page 41, line 7 of first quotation: Change "is quoted" to *are* before "good"

HENRY D. WILLIAMS,
Counsel for Petitioners-Complainants.
WALTER A. SCOTT,
Counsel for Respondent-Defendant.

Supreme Court of the United States, October Term, 1916.

No. 46.

MINERALS SEPARATION, LTD., and MINERALS SEPARATION AMERICAN SYNDICATE, LTD., Petitioners-Complainants,
vs.
JAMES M. HYDE, Respondent-Defendant.

It is hereby stipulated that the following corrections be made in the transcript of record:
Page 448, under heading "Details of Experiments":—
Experiment 8: Change "0.8" to *0.08%*, so that the figures on this line will read:
"0.4 cc. 0.08% 6½ 30.5°"
Experiment 11: Change "0.4%" to *0.04%*, so that the figures on this line will read:
"0.2 cc. 0.04% 8 32°"
Experiment 12: Change "0.002%" to *0.02%*, so that the figures on this line will read:
"0.1 cc. 0.02% 12 32°"

HENRY D. WILLIAMS,
Counsel for Petitioners-Complainants.
WALTER A. SCOTT,
Counsel for Respondent-Defendant.

IN THE

SUPREME COURT OF THE UNITED STATES.

OCTOBER TERM, 1916.

No. 46.

MINERALS SEPARATION, LTD., AND MINERALS SEPARATION AMERICAN SYNDICATE, LTD., PETITIONERS-COMPLAINANTS,

vs.

JAMES M. HYDE, RESPONDENT-DEFENDANT.

ILLUSTRATIONS

BY

PETITIONERS - COMPLAINANTS

TO

THE

SUPREME COURT

OF THE

UNITED STATES.

FOREWORD.

The petitioner will illustrate the only processes which have at any time gone into practical operation (Elmore, Cattermole, and the patent in suit), and in addition, the processes described in the Everson, the Froment and the Kirby patents. In each case that which is described and prescribed in the patent will be faithfully followed, both as to apparatus and as to procedure.

The descriptions will include quotations from the appropriate parts of the patents.

ILLUSTRATION 1.

Everson Patent, No. 348157 (printed R., p. 578), 2nd method.

Description in Record.

This second method is described in the patent as follows:

> "When petroleum or a constituent thereof is used the oil should desirably be first mixed with the ore, then water added containing a suitable amount of free acid * * * the quantity of water being ample for the washing-out operation, which is to follow, and the quantity of acid sufficient to cut the sand away from the otherwise cohering mass. In the case of petroleum or its constituent, paraffine-oil, one or two fluid drams of acid to one gallon of water is sufficient for this purpose. The petroleum which I have used was 30° Baumé, and I have found three fluid drams of oil abundant for properly moistening two ounces of heavy ore, or in the ratio of about a barrel of oil to the ton of ore, the amount being, of course, variable with the relative bulkiness of the ore.
>
> In the use of petroleum, or of a liquid constituent thereof, like paraffine-oil, the condition of the concentrated mass is more liquid than when a vegetable or an animal oil or a fatty constituent thereof is used, and a somewhat different means or method should be employed for removing the sand. In practice, the concentrate, after through agitation of the mass and detachment of the sand, will in this case be preferably removed by means of a constant overflow of water from a washing-out vessel, by which overflow the concentrate will be floated off. Devices and methods now well known in wet separation of ores will be suited to this part of the operation, *bearing in mind that the sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil, and acid.* A proper selection of devices for this purpose will be apparent to those skilled in the wet separation of ores" (R., pp. 581, 582).

Illustration for Court.

Apparatus. Miner's gold washing pan for water concentration.

Materials Used. 56 grams (2 ounces) of deslimed Norwegian copper ores, mixed with

10.5 cc. (3 fluid drams) of a petroleum constituent of a sp. gr. of about 30° Baumé.

Operation. The mixture thoroughly agitated in water acidulated with 0.1% by volume of sulphuric acid (about 1 fluid dram of acid to one gallon of water).

Concentrates then separated by vanning in the pan.

Result. Concentrates mixed with oil, the mixture being heavier than water but lighter than sand, are overflowed in current of water.

ILLUSTRATION 2.

A. S. Elmore Patent, No. 689070 (printed R., p. 612).

Description in Record.

Repeating experiments of George A. Chapman (R., p. 197), and Dr. Charles F. Chandler (R., p. 368).

Mr. Chapman, testifying as to the standard methods used by him in testing the Elmore process in the laboratory in the days when that process was used in the mill, says:

> "I took a glass cylinder that would hold 1200 cc. of water and in this placed 100 grammes of crushed ore. To the ore would be added 600 to 800 cc. of water. Upon this would be placed 100 grammes of thick residuum oil. The stopper would be placed in the cylinder and the cylinder was then gently tipped or revolved in a vertical direction. I would exercise great care not to break up the oil which would bring about a frog's spawn effect. After about thirty tips, that is to say fifteen vertical revolutions of the cylinder, I would let the water pulp settle."

The quantity of acid used is not here described, but it is described in the Elmore patent at R., p. 613, line 4 *et seq.*, as follows:

> "The quantity of acid added in either case is small, as it often need not exceed one five-hundredth part of the volume of oil or water employed in the operation."

Illustration for Court.

Apparatus.	Glass cylinder; capacity about 1200 cc. of water.
Materials Used.	100 grms. of copper ore.
	600 cc. of water.
	0.66 cc. of sulphuric acid (1/500 part of the water).
	100 grms. of thick black oil (1″ layer).
Operation.	The cylinder tipped 30 times, *i. e.*, 15 vertical revolutions.
Result.	A floating layer of oil containing metal entrapped in it.

ILLUSTRATION 3.

Cattermole Patent, No. 777273 (printed R., p. 647).

Description in Record.

The following are excerpts from the Cattermole patent:

Agitation. "In a suitable apparatus, an example of which will be hereinafter described, the ground or pulped ore is caused to be violently agitated, as by a revolving stirrer, in a mixture of water and oil, the liquor being acid. As the agitation proceeds the particles of metalliferous matter agglomerate together and may be observed in the form of granules, the size of which will depend, among other things, upon the percentage of oil used" (R., p. 648, line 9 *et seq.*).

Separation. "The products of the agitation are continuously fed into an up-current separator or jig or similar device, which in the case of the up-current separator separates the metalliferous granules from the gangue by allowing them to fall to the bottom of the vessel and to be carried away by a downward stream, while the particles of gangue are carried away by an upward stream" (R., p. 648, line 20 *et seq.*).

Amount of oil. "The proportion of oil used depends upon its viscosity, the fineness of the ore and other factors, and the consistency and size of the mineral granules desired. The more oil used the larger, softer, and less numerous the granules. With, say 10 per cent of oil to the weight of metalliferous mineral a few pasty masses of oil-agglomerated metalliferous mineral matter will generally result. Oil in excess of this may cause all the granules to coalesce into one soft mass. Usually an amount of oil varying from 4 per cent to 6 per cent of the weight of metalliferous mineral matter present in the ore yields granules of suitable size, consistency, and specific gravity for ready separation from the gangue in the up-current or other apparatus used for classification" (R., p. 649, line 35 *et seq.*).

Illustration for Court.

Apparatus.	Cone mixer or Gabbett.
Materials Used.	400 grams defendant's ore crushed to 80 mesh. 1500 cc. of water containing 0.25% of sulphuric acid. 8.5 grams of Oleic acid (9.5 cc.) [2.1% on ore and 7% on the metalliferous mineral (zinc sulphide) content of the ore].
Operation and Results.	Agitated 10 minutes. No froth. Granules separated by sinking in upcast against an upward current of water.

ILLUSTRATION 4.

Froment Italian Patent, No. 63723, of 1902 (translation printed R., p. 473).

Description in Record.

The following is the full description of the test-tube experiment in the patent:

> "Thus, for example, if in a test tube there is placed ten grammes of sulphuretted copper ore with its gangue, a gram of limestone, the whole reduced to powder, and if there is added thereto 30 grammes of water, a few drops of sulphuric acid and a thin layer of ordinary oil, and the mixture then agitated for a second, the whole of the copperpyrite will instantly rise to the top of the liquid. The metallic spherules pressed one against the other, will become grouped in a magma clearly separated from the remainder of the liquid. If the limestone is in excess or readily attackable, the rapidity of the separation is so great that the copperpyrite is forcibly ejected from the vessel. Therefore, a correct proportion has to be found for a given ore and a given limestone. The small quantity of gangue mechanically entrapped gradually falls, and the sulphides remain in a state of almost complete purity. Such is the principle" (R., p. 473, line 9 *et seq.*).

Illustration for Court.

Apparatus.	A test tube.
Materials Used.	10 grams of defendant's ore crushed to 80 mesh.
	1 gram of powdered calcite mixed with 30 cc. of water.
	A few drops (7 to 10) of sulphuric acid.
	1.3 cc. of winter dark oil (= 11.7% on ore) (thinnest possible layer) added and
Operation.	Violently shaken for 1 second (5 shakes).
Result.	A magma separated from the remainder of the liquid.

ILLUSTRATION 5.

Kirby Patent, No. 809959 (printed R., p. 671).

Description in Record.

The following are excerpts from the patent:

> "The process, as an entirety, in its best form for use with Rossland ores for the purpose stated consists in the following steps:
>
> "First, in thoroughly agitating together (*a*) the pulverized ore or mineral material (*b*) enough water to make with said pulverized ore a flowing pulp, and (*c*) a solution of bitumen in a thin distillable hydrocarbon liquid as kerosene, these materials to be so thoroughly agitated together as to finely subdivide said solution into small globules and bring said globules into contact with substantially all of the pulverized mineral particles which will, by preference, adhere to them.
>
> "Second, in allowing the hydrocarbon-coated particles to float to the surface of the mass, and in rendering this separation substantially complete by gently agitating the mass, and by injecting gas into the same, and preferably also discharging into the mass fine streams of the solution. When the separation is completed, the floating hydrocarbon-coated concentrate is removed for subsequent treatment" (R., p. 672).
>
> "In treating Rossland ores I have found that the most satisfactory results have been attained by using a solution obtained by dissolving in kerosene about 5 per cent, or thereabout, of Trinidad asphalt, or the semisolid residuum of petroleum distillation. Preferably the pulverized ore is mixed with three to five times as much water, by weight, and to this is added a sufficient amount of the kerosene-bitumen solution, excellent results being obtained by using one-fourth to three-fourths as much, by weight, as ore" (R., p. 673).
>
> "The floating concentrates are carried mainly at the lower surface of the hydrocarbon layer, where it is in contact with the water" (R., p. 675).

Illustration for Court.

Apparatus. "Mixing tank A" and "Separating tank B," shown and described in Kirby patent (also shown in respondent's brief, p. 180), omitting only oil recovery adjuncts.

Materials Used. 4000 grms. Rossland ore, 80 mesh.
14000 cc. water.
1000 grms. of a mixture of 95% kerosene and 5% asphalt (25% on the ore).
20 grms. sulphuric acid equal 10 pounds per ton.

Operation. Agitated together in "A" tank for 10 minutes and then discharged into "B" tank, where streams of same oil and air are run in.

Result. A floating layer of oil carrying metal particles, with a few air bubbles in it.

ILLUSTRATION 6.

Patent in Suit, Sulman, Picard & Ballot, No. 835120 (printed R., p. 475, separate printed Patent Office copies).

Description in Record.

The following is the description in the patent of the procedure with Broken Hill ore, using Oleic acid as the oil:

> "An ore containing ferruginous blende, galena, and gangue consisting of quartz, rhodonite, and garnet (Broken Hill ore) is finely powdered and mixed with water containing a fraction of 1 per cent, or up to 1 per cent, of a mineral acid, * * * conveniently sulfuric acid. * * * To this is added a very small proportion of Oleic acid (say from 0.02% to 0.5% on the weight of ore). The mixture is warmed, say, to 30° to 40° centigrade and is briskly agitated in a cone mixer or the like, as in the processes previously cited (Cattermole patents), for about two and one-half to ten minutes, until the Oleic acid has been brought into efficient contact with all the mineral particles in the pulp.
>
> "When agitation is stopped, a large proportion of the mineral present rises to the surface in the form of a froth or scum which has derived its power of flotation mainly from the inclusion of air-bubbles introduced into the mass by the agitation, such bubbles or air-films adhering only to the mineral particles which are coated with Oleic acid. The minimum amount of Oleic acid which can be used to effect the flotation of the mineral in the form of froth may be under *0.1 per cent of the ore,* but this proportion *has been found suitable and economical*" (R., p. 1, lines 72-101).

Illustration for Court.

Apparatus. Gabbett or cone mixer, with rectangular vessel.

Materials Used. 800 grams of Broken Hill tailings, 80 mesh, added to

2400 cc. of water, containing 12 grams of sulphuric acid (= 6.6 cc.).

Temperature of mixture about 40°C.

0.9 cc. Oleic acid (=0.1%)

added, and the mixture

Operation. Agitated 10 minutes.

Result. Metal rises in froth deriving its power of flotation from air bubbles.

Supplemental Operation.

Material Used. Add 32 cc. Oleic acid (=3.6%).

Operation. Same agitation repeated for same time.

Result. Froth destroyed, metal sinks.

ILLUSTRATION 7.

Infringement.

Description in Record.

Substantially the same as Illustration 6.

Illustration for Court.

Apparatus Used. Slide machine.

Materials Used. 500 grams of defendant's coarse crushed ore, 80 mesh.
2000 cc. of water.
Temperature about 40 deg. C.
37.5 cc. of 5% sulphuric acid.
0.875 cc. of Oleic acid (0.16%).
Agitated for 2 minutes.

Results. Metal rises in froth deriving its power of flotation from air bubbles.

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SUPREME COURT OF THE UNITED STATES.

MINERALS SEPARATION, LIMITED, and MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED,
Petitioners-Complainants,

AGAINST

JAMES M. HYDE,
Respondent-Defendant.

Brief for Petitioners-Complainants.

This is a suit in equity, originating in the United States District Court for the District of Montana, for injunction and damages for infringement of patent No. 835,120, issued July 6, 1906, to Sulman, Picard and Ballot for a process of ore concentration.

The distinctive feature of the invention patented is the employment of air bubbles in co-action with a minute and critical amount of oil in a mixture of ground ore and water so as to produce upon the surface of the water a froth containing substantially all of the metallic particles which can be easily flowed off or removed.

This process was never used before. This result was never obtained before. The process is dependent upon the use of oil in a minute and critical amount and thorough aeration. If more oil is used, you do not operate the process, and you do

not get the result. So also if less oil is used the process is not operated and the result is not obtained. By using other and greater quantities of oil you operate a different process and you obtain wholly different results. That the critical amount of oil characterizing the process is a minute amount of oil (varying slightly with different ores and different oils) is merely a fortuitous circumstance. Nevertheless the process is dependent upon such definite minute amount of oil. Obviously therefore it cannot be said that the use of the minute amount of oil characterizing the process in suit, as compared with prior disclosures suggesting the use of greater amounts of oil, is a mere improvement in degree suggested by the desire to economize in the use of oil, since every prior disclosure with which the process may be compared was wholly different in characteristics and essential mode of operation and principles involved and result obtained. The process of the patent in suit evokes new principles, employs a new mode of operation, and produces a new result, not theretofore evoked, employed or produced.

In support of the above we have the decision of Judge BOURQUIN of the District Court of Montana, of Judge BRADFORD of the District Court of Delaware and of the officials of the Patent Office in granting the patent in suit, in this country, and abroad we have the judgment of Justice NEVILLE of the British High Court of Justice, of Chief Judge in Equity SIMPSON of the Supreme Court of New South Wales, Australia, of the British House of Lords (former Lord Chancellors Lord LOREBURN and the Earl of Halsbury, and Lords ASHBOURNE, ATKINSON and SHAW), and of the Privy Council of the British Empire (former Lord Chancellor Viscount HALDANE, and Lords DUNEDIN, PARKER, SUMNER and PARMOOR). The sole decision to the contrary is the opinion of the Circuit Court of Appeals of the Ninth Circuit here under review.

It should be noted as to the British courts and the Australian court that the extent of their findings was as to the novelty and unusual character of the process here in suit, and that they did not have before them a few of the later prior disclosures dealt with by the American courts, as will hereafter be fully explained.

Prior Proceedings and Adjudications.

After final hearing on pleadings and proofs, Judge GEORGE M. BOURQUIN of the District of Montana adjudged the patent valid and infringed, and an injunction was issued to restrain further infringement and an accounting ordered. Judge BOURQUIN'S opinion (R., pp. 18–25), was filed July 28, 1913, and is reported in 207 Fed., 956.

An appeal was taken to the United States Circuit Court of Appeals for the Ninth Circuit, and after argument therein before Circuit Judges GILBERT and ROSS, and District Judge DIETRICH of Idaho, the decree was reversed and a decree directed dismissing the Bill. The ground of reversal was that the patented process, although new and useful, was unpatentable. The opinion (R., pp. 715–723), filed May 4, 1914, was written by Judge GILBERT, and is reported in 214 Fed., 100.

Thereafter a petition for rehearing (R., pp. 725–746) was filed by the complainants, and to this petition was annexed a copy of the judgment of the Privy Council of the British Empire in *Ore Concentration Co. (1905), Ltd., v. Sulphide Corporation, Ltd.*, 31 R. P. C., 206 (R., pp. 747–756) (wherein the defendants employed the process of the patent here in suit), which had been rendered on March 6, 1914, in the interval between the argument and the decision in the Ninth Circuit Court of Appeals. This petition for rehearing was denied on July 6, 1914 (R., p. 757).

Thereupon the petition to this court for a writ of *certiorari* was filed and was granted.

Another British adjudication wherein the defendant used the process of the patent here in suit, was referred to in the petition for the writ of *certiorari*. It is the judgment of the British House of Lords in *Minerals Separation, Limited, v. British Ore Concentration Syndicate, Limited*, 27 R. P. C., 33 (Printed in Appendix to Petition for Writ of *Certiorari*, pp. 41–62). This was rendered November 16, 1909, prior to the commencement of the suit at bar.

After the decision of the United States Circuit Court of Appeals for the Ninth Circuit in the case at bar, another suit was commenced by Minerals Separation, Ltd., one of the com-

plainants here, against Miami Copper Company, a Delaware corporation, for infringement of the broader claims of the patent here in suit and of two later patents of the complainant Minerals Separation, Ltd. The case was tried in open court for a period of nine weeks, and on September 29, 1916, was decided in favor of the complainant and the validity and infringement of claims 1 and 12 of the patent here in suit were affirmatively adjudicated. The particulars of this decision will be considered at the end of this brief (*infra*, pp. 252, *et seq.*). The defendant relied largely upon the decision of the Circuit Court of Appeals of the Ninth Circuit in the case at bar, but Judge BRADFORD reached conclusions wholly contrary to those expressed in that decision and in agreement with those of Judge BOURQUIN in the case at bar.

Thus, as to the patentability of the invention in issue we have the affirmative findings of impartial government officers after, in one instance (the granting of the patent), an investigation of prior disclosures by the skilled experts of the Patent Office, in a second instance (Judge BOURQUIN'S decision), a final hearing on pleadings and proofs, and in a third instance (Judge BRADFORD'S decision) a long trial in open court.

Additionally, in the two British suits, the defendants wherein employed the process here in suit, the findings were in substance that the process in suit was novel, distinct and different from the invention sued upon, the Elmore bulk-oil and oil-buoyancy flotation process, and the prior art fully considered in these suits included a part of the prior art considered in the case at bar; and here, not only were the final judgments in the House of Lords and in the Privy Council favorable to the contentions of the complainants in this suit, but both trial courts, after long trials in open court, that in the Australian suit, which reached the Privy Council, having "occupied thirty-one days" (31 R. P. C. 214), found in favor of the defendants there, in one instance Minerals Separation, Ltd., one of the complainants here (British Ore Concentration, Ltd. v. Minerals Separation, Ltd., 25 R. P. C. 741; High Court of Justice, Chancery Division, Mr. Justice NEVILLE), and in the other instance, Sulphide Corporation, Ltd., a licensee of that complainant (see report

of Privy Council judgment, wherein the judgment of Chief Judge in Equity SIMPSON of the Supreme Court of New South Wales is reported in full, 31 R. P. C. 216, 217).

Thus we have the Patent Office, four trial courts, and two courts of last resort, in agreement as to the novelty and unusual character of the process here in suit, and, in disagreement, only the conclusions in that regard expressed in the opinion of the Ninth Circuit Court of Appeals in the case at bar.

Parties.

The first named petitioner-complainant in the case at bar, Minerals Separation, Limited, is a British corporation. It was the defendant in the above mentioned case decided by the House of Lords; and its licensee, Sulphide Corporation, Limited, of Australia, was the defendant in the above mentioned case decided by the Privy Council of the British Empire. The other petitioner-complainant, Minerals Separation American Syndicate, Limited, is also a British corporation and is the general American licensee under the patent here in suit.

The respondent-defendant, James M. Hyde, is a former employee of your petitioners and was by them trained in the use of the process of the patent in suit, and thereafter installed and used the process at Basin, near Butte, in Montana.

The Invention.

The patentees of the patent in suit are pioneers in the successful use of air or aeration in the concentration of ores. The effect of their discovery and its successful application to the concentration of ores—the separation of the metal particles from the gangue or rock or sand of the ore—has been the saving of vast quantities—millions of tons—of valuable metal which previously were wasted. Additionally it has provided a procedure so simple, so highly efficient and so economical that the prior procedure of the art has already been largely

and will probably be wholly superseded. The process of the patent in suit has revolutionized the art of ore concentration.

There is absolutely no record or evidence of the carrying on of any practical operation prior to the invention in suit wherein air was used in the concentration of ores. The invention was wholly new as a practical, or useful, or used process in the art of ore concentration. After it had been made and put into use and had demonstrated its great value, the defendant, in the attempt to justify infringement, dug up from obscurity everything having the faintest reference to this subject, but failed to find a record or to obtain any evidence of any such practical operation. The defense is therefore confined to an effort to show the court that the disclosures of prior documents would have been useful in the concentration of ores if they had been used, and this the defendant attempts to prove by experiments in miniature—laboratory manipulations—alleged to represent the prior art, but in fact misrepresenting it, and of no probative force as to what would have been practically useful in the mill even had they been faithful and honest procedures truthfully representing prior knowledge (see Judge BRADFORD'S decision, p. 39). The absolutely conclusive answer to defendant's contention in this regard is the undisputed fact that until complainant's process was put into successful operation there was no successful process at all of like character. All the previous attempts to practically use other processes, adverted to by the defendant, were failures and were discarded. Complainant's process not only did not suffer a similar fate, but was eminently successful and its use grew extensively and will soon be practically universal—superseding all other processes.

The secret of the invention of the process in suit was the discovery that by the agitation and aeration of an ore pulp (water and finely ground ore particles, the water when in motion carrying the ore particles in suspension therein) in the presence of a mere trace of oil such that the metal particles were coated with a thin attenuated coating of oil, so thin as to be imperceptible to sight or touch and so attenuated as to exhibit none of the known properties of oil, air bubbles would be produced and controlled and made persistent that would

firmly attach themselves to the metallic particles and by their buoyancy float the heavy metallic particles upward to and through the surface of the pulp, and form above and resting upon the surface of the pulp a floating layer—usually several inches in thickness—of a mineral froth constituted of such air bubbles carrying the metallic particles. This was accomplished in practice by the employment of oil in the minute proportion of one-tenth of one per cent. on the ore.

At the date of the invention of the patent in suit the mining world had nothing at its disposal for concentrating ores except the water concentration process. The underlying principle of this process is difference in sinking power in water, and its comparative inefficiency is due to the fact that no grinding operation for the reduction of ore to small particles, however carefully manipulated, can avoid the production of a very considerable amount of slimes. Slimes or extremely fine particles will not sink in water as rapidly as the larger particles, and therefore the metal in the slimes flows away with the gangue and is not separated, and this accounts for the great heaps of waste material from which the process in suit has separated the valuable metals, changing dumps into dollars.

The water concentration process is carried on with a great amount of machinery—shaking jigs with upward streams of water, water upcasts with upward streams of water, and shaking tables with streams of water flowing over them. The heavier metallic particles go to the bottom while the lighter gangue particles are carried away by the water, and with them are carried away the valuable metal slimes. In the efforts to improve upon water concentration, two associated prior inventors, the Elmores, had floated the metallic particles to the top by the buoyancy of oil (a ton of oil to a ton of ore), and their process had been used to some extent and then abandoned, and one inventor, Cattermole, had sunk the metallic particles to the bottom by the agglutinating action of oil, employing for that purpose a very much smaller quantity of oil than the Elmore process (from a minimum of one and one-half per cent. on the ore up to about three per cent.), which oil with suitable agitation brought about the agglutina-

tion of the metal particles into granules large enough to reliably sink against a current of water that would carry the unagglutinated and ungranulated sand and gangue upward and away. Beyond this there were efforts to reduce the consumption of oil in the Elmore process by aerating a floating mass of oil and metal (like cork or sponge) so as to float the mass with less oil than was required in the practical and usable Elmore process. These efforts failed. The procedures were not usable in practice. Furthermore one of these inventors, Froment, and the patentees of the patent in suit groped about in efforts to utilize air and other gases to carry upward in water metal particles oiled in Cattermole or larger proportions. These efforts also failed. The procedures were not usable in practice. They failed because the oil quantities were too great, although that fact was not known at the time. The oil coatings on the metal particles impaired or destroyed the attraction of the air bubbles for the metal particles, and while the oiled metal particles would weakly attach themselves to some extent to the air bubbles when the air bubbles were immersed in the water, that attraction disappeared the moment the air bubbles reached the surface, and the bubbles burst, and the particles were then left to float or sink without any further assistance from the air bubbles. To carry on a process of ore concentration under any of these conditions was impossible, and the attempt to utilize air failed.

The patentees of the patent in suit spent more than two years in the study of the Cattermole metal-sinking process and in efforts to improve it, and continued to do so, and actually installed it on a practical scale in Australia, after they had given up the attempt to utilize air or gas in metal-floating processes. About a year after they had given up this effort they pursued an elaborate investigation of all the factors of the Cattermole metal-sinking process, this investigation being for the purpose of improving the Cattermole metal-sinking process; but this investigation included a determined effort to find the smallest quantity of oil that would produce any effect whatsoever under the conditions assembled. From this investigation

emerged suddenly and unexpectedly, and to the great surprise of the investigators, the process of the patent in suit.

The process of the patent in suit is commonly known as the flotation process, although it is often more specifically described as the agitation froth process. In carrying it on the ore is ground to a fine powder, finer than ever before, and thereby reduced to separate particles of valuable metal or metalliferous mineral (usually the sulphides of metals) and of worthless rock or gangue. These ground ore particles are mixed with a considerable amount of water so as to form a freely flowing pulp (four or five tons of water to one of ore). An oil is added in the singularly minute quantity or trace above stated, about one-tenth of one per cent. of the weight of the ore (two pounds of oil to a ton of ore in about four or five tons of water, constituting five or six tons of ore pulp), the mixture is briskly agitated under conditions that send myriads of minute bubbles of air coursing through the liquid, and these bubbles of air repel the rocky or gangue particles and attract, and firmly attach to themselves the metallic particles, and float the metallic particles upward to and through the surface of the pulp and form above and upon the surface of the pulp a deep floating layer of what is literally a mineral froth constituted of air bubbles carrying metallic particles. This mineral froth, carrying substantially all the metallic values of the ore, is floated off over a wall or dam, and thus the valuable metallic particles are separated as concentrates, while the worthless rocky or gangue particles remain in the pulp. An acid is in some instances used in the pulp to promote or improve the separation, and heat is in some instances used for the same purpose, and both heat and acid are in many instances used, as for example, by the defendant herein. In the process as originally discovered and applied in use, with the ore treated and the oil used, both heat and acid were necessary.

The process of the patent in suit solved the slimes problem, in fact it recovers slime metal more readily than larger particles. It reorganized the grinding of ore, and now the millman grinds finely without fear of loss, assured that he will in

the grinding operation certainly free all metal particles from gangue particles, and that the slime metal particles will be recovered in the concentrates.

Although the process was invented more than ten years ago—in March, 1905—and has been extensively used commercially practically from discovery, and in the concentration of millions of tons of ores, largely dumps and waste products theretofore wholly untreatable by any process, its principles of operation are not yet fully understood. It is the most important invention in the concentration of ores of the present day. Its operations on any scale, large or small, are reliable and inevitable. The operation proceeds by the contact of minute air bubbles with minute particles of metal in a freely flowing pulp under circumstances conditioned by the presence of the minute quantity of oil and with opportunity for the flotation of the buoyant air bubbles with their attached metallic particles after contact. It is known that oil has some sort of selective affinity for metallic particles as contrasted with the gangue. It is known that metallic particles tend to attach themselves to air bubbles immersed in a liquid. It is known also that the presence of oil in the pulp in the minute quantities specified maintains minuteness of air bubbles in the liquid and gives persistence to the air bubbles as such and firm attachment of the metallic particles thereto both when the air bubbles are still coursing through the liquid and also when they escape upward out of the liquid and float above the surface of the liquid in a dense froth carrying the metallic particles. It is known that the laws of surface tension apply throughout the process, but in so intricate a manner that no generally accepted explanation exists. It is also known that the process is destroyed if the amount of oil is increased over the minute proportions characteristic of the process.

This latter fact, namely, that the process is in each instance conditioned on the use of definite and astonishingly minute oil proportions (varying slightly with different ores and different oils), is one of the important facts that is clearly proved in the evidence in behalf both of complainants and of defendant which the Circuit Court of Appeals overlooked or

disregarded. Defendant's foreman, after conducting defendant's process for many months, testified for defendant as to the working instructions received by him from defendant and which governed his operation of the process as follows :

> " I was instructed by Mr. Hyde as to the regulation of the supply of oil * * * to use oil * * * in such quantity as to produce the best result. I was told that the use of too much oil is indicated by a flat film on the surface of the water, the mineral forming globules and sinking ; * * * that when too little oil is used, there is no separation of the minerals and waste " (R., Gibson, p. 75).

From the above evidence of defendant and other abundant evidence in the record it appears that for a given ore and a given oil, a definite minute amount of oil is essential to the carrying on of the process ; that any substantial increase or diminution of this critical quantity of oil impairs or destroys the process ; and that the production of the peculiar mineral froth characteristic of the process is recognizable by metallurgists skilled in this new art as an infallible indication of the use of the process (R., Chapman, pp. 195, 196, Qs. 110, 111 ; Liebmann, p. 335, Qs. 46–48 ; Ballantyne, pp. 229, 230, Qs. 29–31 ; Nutter, p. 46, x-Q. 150 ; Picard, p. 154, Qs. 73–75). As Mr. Sulman, one of the inventors and himself an eminent metallurgist and scientist says : " the phenomenon of the agitation froth production is in itself an indication of the right amount of oil to employ " (R., p. 139).

The history of the art demonstrates that with the conjoint use of air and oil, flotation-concentration is wholly impracticable unless the minute quantity of oil characterizing the process in suit is used.

In the opinion of the Circuit Court of Appeals in the case at bar patentability is denied to this invention for the stated reason that a reduction in the quantity of oil from that of prior disclosures is a mere matter of *degree*. This rests upon the assumption that the result obtained by the process of the patent in suit could have been obtained in the processes made known by prior disclosures, and that the only novelty of the

patent in suit was the economical use of oil. This assumption has nothing whatever to rest upon and all the evidence in the case shows it to be a false assumption. The only process which produces the result obtained by complainants' process is the complainants' process. Its characteristic is the mineral froth composed of metal and air bubbles, and such mineral froth so composed does not result in the use of any other process involved in prior disclosures. That this result is due to the minute proportion of oil employed in the process does not properly lead to the conclusion that the process is comparable with other previous processes and when so compared differs only in degree. The basis for this argument is utterly lacking in the proofs. There is no proper basis of comparison because the results aimed at and produced by the other processes are totally different from the result produced by complainants' process. Some of the previous processes used oil to produce oil buoyancy, others to produce agglutination and sinking, and others to produce suspension of the valuable metal in the liquid above the gangue. No one of them used oil for the purpose of producing the successful application of aeration to the valuable metal so as thereby to produce the metal froth characteristic solely of the complainant's process. The novelty characterizing the process in suit and the great utility of that process are conceded in the opinion of the Circuit Court of Appeals. When to what is conceded by that opinion is added the further fact established by the evidence that no practical process of flotation-concentration employing air and oil was known or was ever used prior to complainants' invention, the argument of invalidity demonstrably fails.

Errors of Law in the Opinion of the Circuit Court of Appeals.

These errors of law may be summarized as follows:

1. In holding that the process of the patent in suit was devoid of patentable novelty, although admittedly novel in the matter of the minute quantity of oil used, and although

admittedly highly useful and in extensive use, and although none of the alleged anticipating disclosures described a flotation process which had achieved any usefulness in the practical art.

2. In holding that the process of the patent in suit was a mere matter of economy in oil and followed naturally and without invention from what was previously known in the art; and in overlooking in that connection the testimony in the case which showed that all efforts to reduce the quantity of oil in prior commercial oil processes were failures, except in the Cattermole metal-sinking process, and that the patentees' efforts to economize oil in that metal-sinking process suddenly upon reaching a critical point of minuteness of oil quantity employed, reversed the entire phenomena, evoked opposite and unexpected and not even yet fully understood principles of action and modes of operation, and delivered the metal values at the top in a floating froth, the like of which for practical metal concentration purposes had never been known before.

3. In accepting unverified miniature court-room experiments at the argument on appeal, unsupported, except by assertions of Counsel, and not repetitions of experiments that had been made the subject of testimony, as (*a*) illustrating old processes disclosed in prior documents and as (*b*) evidencing that these processes were capable of practical use in the mill.

4. In adjudging from ocular observation of these unverified miniature court-room experiments (*a*) the nature of the result; (*b*) the efficiency of the result; (*c*) the fact that the phenomena thus exhibited on laboratory scale were capable of use in practical operations in the mill.

5. In giving any consideration whatsoever to such unverified court-room experiments, which were not repetitions of experiments sworn to by witnesses, which were not themselves sworn to, which, if evidence, under oath with the privilege of cross-examination would have been new evidence received at the argument of the appeal.

6. In holding that mere paper patents (the Froment Italian and British patents) were effective as anticipations, although they admittedly did not fully describe the invention of the patent in suit.

7. In confusing the disclosure of these mere paper patents with the disclosure of a private document (the Froment description) and then applying to the joint disclosure the rule as to the presumption of operativeness and some utility attending the grant of United States letters patent.

8. In applying the rule as to the presumption of operativeness and some utility which attaches to the grant of a United States patent, to the Froment Italian and British patents which disclose only a little test-tube experiment from which the only presumption would be that the test-tube experiment could be performed—a disclosure which would not be sufficient for the purposes of a United States patent for a process of concentrating ores.

9. In treating two patents (Schwarz and Kirby) issued subsequent to the invention of the process in suit on applications filed prior to the invention of the process in suit, as prior art, although these applications on file in the Patent Office were secret and were obviously not published or known to the art at that time; and in holding that they anticipated the invention in suit, although they admittedly did not describe the precise invention of the patent in suit.

10. In treating an unpublished and private document (the Froment description) as a part of the prior art and applying thereto the rules as to anticipation which are applicable only to the prior published or patented or publicly known or used art; and in holding that it anticipated the invention in suit, although it admittedly did not describe the precise invention of the patent in suit.

11. In failing to apply to each and every prior document referred to as anticipative, namely, the Haynes, Everson, Froment and Cattermole patents, the Criley and Everson publication in the Engineering and Mining Journal, the Froment private description and the Schwarz and Kirby secret patent applications, the rule of law that a prior document which does not disclose the precise invention and which does not disclose anything usable in practice, is not anticipative (it being noted that the Cattermole process, although usable and used as a metal-sinking process, was not a metal-floating process),

The Circuit Court of Appeals in its opinion says of the processes disclosed in prior documents and the process of the patent in suit:

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth in all these processes is the same, with the exception that there is *less oil (as there must necessarily be)*, in the appellees' froth than in the others. The froths are all similar in appearance, they all rise to the surface after the same amount of agitation, they all gather with equal efficiency the same quantity of metal, and all may be removed from the surface in the same way" (R., pp. 720, 721; italics ours).

It is respectfully submitted that the evidence in the case furnished no foundation whatever upon which to base a conviction "that the froth in all these processes is the same." The undisputed fact, so far as the evidence in the case is concerned, is that the metallic froth produced by complainant's process is unique and characterizes such process and distinguishes it from all other previous processes.

If the conviction as stated by the court was induced by the illustrations and demonstrations referred to by it, it is obvious that such illustrations and demonstrations must have dealt with something outside of and other than the previous processes as established by the evidence in the case. The error of law in founding the judgment of the court thereon is too clear to require argument.

Here again a conclusive answer to the assertion of such a conviction as expressed by the court is that until complainants' process was put into practical operation there was no process in use which produced a similar result. If an identical or practically identical result was obtainable by some one or more of the other previous processes, why was it that they were all discarded and unused? If this novel discovery which since the complainants' process has gone into operation has revolutionized this branch of the mining industry and resulted in the saving of millions upon millions of dollars of metals

was known before the complainants' invention, why did the mining world not use it? There can be and there is only one answer, and that is that it was not so known, was not discovered previous to the complainants' discovery, and that the complainants' invention was its first disclosure to the public.

It is conceded in the opinion that there is a "material difference" between all of these processes and the process of the patent in suit "in the smaller quantity of oil which the appellees use" (R., p. 718), that the "discovery" of the patentees was "that a small fraction of one per cent. of oil is sufficient to produce flotation of the metalliferous matter" (R., p. 723); that they discovered "that the desired result may be accomplished with the use of a fraction of one per cent. of oil when formerly a much larger quantity of oil had been used, and had been deemed necessary" (R., p. 719). It is further conceded in the opinion that "the patentees of the appellees' patent made a valuable contribution to the art in discovering the smallest quantity of oil which would produce the desired result" (R., p. 723).

Additionally it is stated in the above full quotation that there must necessarily be less oil in the appellees' froth than in the others. Thus without any question the Circuit Court of Appeals found as a fact that the minute quantity of oil characterizing the process of the patent in suit was new.

The Circuit Court of Appeals also found that the process of the patent in suit, characterized by this novel minuteness of oil proportion, was highly useful. It is said in the opinion:

> "The appellees' process, originally patented in Great Britain, has been installed in Australia, Sweden, Finland, Chile and Wales, and it is in the process of installation in Cuba" (R., p. 722).

And further said:

> "The decision of the Court below appears to have been largely influenced by the consideration that the appellees' patent had gone into extensive and successful use" (R., p. 721).

The statement in Judge BOURQUIN's opinion from which this inference arose was as follows:

> "Complainant's process has, in instances, displaced some of the prior, and has firmly established itself as a new and valuable method of ore reduction. The evidence shows many and large plants thereof, built or building in widely separated parts of the world. Its successful operations, practically from discovery, have recovered, and largely from waste and tailings, values aggregating near $9,000,000 and at a profit of near $4,000,000 to the patent owner and its licensees" (R., p. 21).

The testimony in London proving the facts from which Judge BOURQUIN states these conclusions, was closed in August, 1912. Of the colossal use of the invention since that day, largely under licenses from the patentees, throughout the world generally and the United States in particular, the record contains no evidence.

The prior processes displaced by the process of the patent in suit were not those relied upon by the Circuit Court of Appeals to anticipate the invention. The latter existed only in documents. The practical art did not use them. The evidence is that they are all incapable of successful use, with the single exception of the Cattermole process, which, as a metal sinking process, which it alone is, was used for a few days only, and thereafter replaced by the process of the patent in suit.

Upon this evidence and upon the facts found to be true by the Circuit Court of Appeals, it was error of law to hold that the admitted difference between the admittedly highly useful process of the patent in suit and all prior known processes, in the minuteness of the quantity of oil used, did not involve invention.

It also appears from the opinion of the Circuit Court of Appeals, in the part above fully quoted, that demonstrations of the various processes were made in aid of the argument before that Court, and that these demonstrations, with the evidence in the case, convinced the Circuit Court of Appeals of the equal efficiency of all of the processes. In this connec-

tion it is to be remembered that there was no evidence in the case of any successful use as flotation processes in practical operations of any of the prior processes held to anticipate. The Circuit Court of Appeals, therefore, accepted unattested the court-room experiments at the hearing as

(a) illustrating old processes disclosed in prior documents, and as

(b) evidencing processes capable of practical use in the mill.

This was error of law, violating the fundamental rules of court procedure.

Further it appears from the opinion of the Circuit Court of Appeals that the Court adjudged from *ocular observation* of these unattested court-room demonstrations

(a) the nature of the result.

(b) the efficiency of the result.

(c) the fact that the phenomena thus exhibited on laboratory scale were capable of use in practical operations in the mill.

This again was error of law. The unattested court-room demonstrations should have had no weight whatsoever. In adjudicating the rights of the parties, the Circuit Court of Appeals, usually the court of last resort, should have founded its decision wholly upon the evidence in the Record brought to that Court. Valuable patent rights of litigants should not be overthrown by the dexterity of skillful experimenters in unattested alleged demonstrations—experiments which may well not have represented the prior processes and which may well not have represented processes capable of use in practice. In fact, the alleged demonstrations made by defendant at the hearing before the Circuit Court of Appeals were sham experiments. They were deceptive. They did not represent the prior art. They were not practical operations capable of use in the concentration of ores. They did not, even in miniature, as carried out in court, effect substantial concentration. They were carefully studied experiments for the purpose of deceiving the

Court, and they appear to have been successful in deceiving the Court.

Except for the statement in the opinion that "illustrations" of the prior art and of the process of the patent in suit were "afforded by demonstrations of the various processes which were made in aid of the argument before this court," there is nothing in the record to show what these illustrations or experiments were. Indeed the printed slips alleged to describe these experiments which were handed by defendant's counsel to the Court and to adverse counsel during the argument, would obviously show nothing of probative value. The materials used were not analyzed and no one swore what they were. The floats obtained were not analyzed and there is not even opinion evidence as to what they contained. Their composition could have been determined only by chemical analysis. The only conclusion which can be certainly reached from the record as to these experiments is that the Circuit Court of Appeals erred in giving to them any consideration whatsoever.

It may be noted, however, that in the petition for rehearing (R., pp. 725-746), denied without opinion, attention was repeatedly called to these experiments and their deceptive character. We quote as follows:

> "At the argument appellant's counsel made certain unproved alleged demonstrations of the prior art, and many statements not in any manner borne out by the evidence. Not only were the laboratory productions which were exhibited to the Court by the appellant at the hearing variant from and inconsistent with the described experiments of their expert witness which were alleged to represent the prior art, but they were wholly different from anything disclosed in the prior art. And the described experiments of appellant's expert witnesses were also wholly different from anything disclosed in the prior art.
>
> Briefly summarizing:
>
> 1. Appellant's evidence does not describe a single experiment representative of the prior art.
>
> 2. Appellant's court demonstrations erred doubly in not representing the prior art and in not reproducing what had been testified to by appellant or his expert" (R., pp. 725, 726).

These experiments are referred to throughout the petition but are not particularly described (R., pp. 732, 734, 738, 739, 740, 741, 746). From the conclusion we quote as follows :

> "We also feel that the Court's decision was influenced by a mistake of fact caused by the laboratory demonstrations made by appellant's counsel in open court at the oral argument. Those demonstrations were claimed by appellant's counsel to be representative of the prior art; but we earnestly contend that they were not demonstrations of the prior art, nor were they representative of any process shown in the prior art. They are wholly different from anything disclosed in the prior art. Apparently these laboratory demonstrations had much weight with the Court, and, partially at least, influenced the decision. If, therefore, they were not demonstrations of anything shown in the prior art, then manifestly the decision of this Court was influenced by a mistake of fact, and a rehearing ought to be granted" (R., p. 746).

An obvious error of law appearing in the opinion of the Circuit Court of Appeals was in the application of the rule as to paper patents—patents disclosing inventions that have not gone into use. The Court of Appeals says :

> "A paper patent, if it fully describes an invention, whether it be a machine, device or process, is just as effective to show anticipation as a patent which describes an invention which has gone into extensive use, for a presumption of operativeness and of some utility attends the granting of letters patent" (R., p. 719).

This rule, as stated, was misapplied, for the reason appearing in the opinion that the paper patents referred to, the Froment patents (Italian and British, both for the same invention) did not fully describe the invention, but described something different—a procedure which required a much larger quantity of oil. Obviously also this rule was misapplied as to all of the prior patents held by the Circuit Court of Appeals to anticipate the invention of the patent in suit, which were all in the class of paper patents except Cattermole; and Cattermole was a metal sinking process, usable and used only as a metal sinking process.

The quotations from the Telephone Cases which follows this statement of the rule (R., p. 719) was wholly misapplied, since what was there said by this Court as to the highest degree of perfection not being required in the disclosure of a patent, was said of the Bell Telephone invention, which, like the patent here in suit, created a wholly new art. It was error of law to apply the rule there stated to a paper patent disclosing a worthless invention that created nothing.

Another error of law was the confusion of the Froment description with the Froment patents. The common disclosure of these two patents is briefly summarized in the opinion (R., p. 717). Then reference is made to the fact that thereafter Froment sold his patents to the patentees of the patent here in suit, and sent to them a written description, drawings and a model plant, and the fact quite clearly appears that the procedure thus disclosed was quite different from that disclosed in Froment's patents (R., p. 718). Thereafter the disclosure of the Froment patents and the disclosure of the Froment description are blended in the opinion, as the Froment process (R., p. 718), and then the rule as to the presumption of operativeness attending the granting of letters patent is applied. Obviously any presumption arising from the grant of the Froment Italian and British patents does not arise as to the Froment description, which was an unpublished and private document describing a different procedure, and which remained a private document until it was voluntarily put in evidence by the complainants in this suit.

Again it was error of law to apply to the Froment Italian and British patents (Froment had no United States patent) the rule as to the presumption of operativeness and some utility which attaches to the grant of a United States patent, since these patents merely disclosed a procedure carried on in a test-tube with less than half an ounce of ore—a laboratory test—and did not disclose any working process, and were in fact patents for a test-tube experiment alleged to be a process of concentrating ores. The only presumption that could arise from such a patent would be the presumption that this little test-tube experiment could be performed. An application for a patent in this country containing such a disclosure would have been rejected for failure to disclose any

practical operation. Our government does not grant patents for test-tube experiments as processes of concentrating ores.

It was error of law to treat the Schwarz and the Kirby United States patents, issued long after the origination and the record dates of the invention of the patent in suit, as patents of the prior art, in other words, as anticipating patents. The opinion says :

> " Turning to the patents which are adverted to as showing the prior art, we find the following " (R., p. 716).
>
> " The Schwarz United States patent No. 807,503, applied for in May, 1904, and granted in December, 1905 " (R., p. 717).
>
> " The United States patent to Kirby, No. 809,959, was applied for December 14, 1903, and granted January 16, 1906 " (*idem.*).

The discovery and first use of the remarkable new procedure constituting the process of the patent in suit, was made in London, England, in March, 1905. The application for the British patent for this invention, No. 7,803 of 1905, was filed April 12, 1905. The application for the patent in suit was filed in the United States Patent Office May 29, 1905, and under the provisions of the International Convention for the protection of Industrial Property, as enacted in U. S. R. S. Section 4887, the record date of the origination of the invention of the patent in suit is the date of the filing of the British application, more than eight months prior to the date of issuance of the Schwarz patent and more than nine months prior to the date of issuance of the Kirby patent. The only documents describing the Schwarz and Kirby inventions which were in existence at the controlling date of invention of the process for the patent in suit were the applications for the Schwarz and Kirby patents on file in the secret archives of the United States Patent Office. Defendant could therefore only avail himself of the secret applications as prior secretly filed documents, and this was done by pleading them as evidence of prior invention by Schwarz and Kirby, respectively. It is contended in behalf of the petitioners-complainants that under these conditions prior documents can only be effective as disclosures of the precise invention in

question; that a prior application for a patent is neither a prior patent nor a prior publication, nor is it prior art; that it goes merely to the issue of originality or priority with respect to the precise invention in question. There is conflict between the Circuit Courts of Appeals of various circuits as to this rule of law. The subject is hereinafter carefully considered, with a review of the authorities (*infra*, pp. 237, *et seq.*).

It may be noted also that the Circuit Court of Appeals included the Froment description, an unpublished and private document, as a part of the prior art to which it applied the rules as to anticipation which are applicable only to the prior published or patented or publicly used art. As to this, there is no conflict of adjudication, and it is manifest error of law.

It may be noted also that, as the opinion of the Circuit Court of Appeals conceded the novelty of the process of the patent in suit in the minuteness of the quantity of oil employed, the application of the proper rule that prior patent applications or other unpublished documents must disclose the precise invention, eliminates Schwarz, Kirby, and the Froment description. The application of the proper rule of law that prior paper patents which do not fully describe the invention do not anticipate, eliminates the Haynes, Everson and Froment patents, and the obviously similar rule of law as to publications eliminates the Criley and Everson publication in the Engineering and Mining Journal of November 15, 1890 (R., p. 720), and we have left the Cattermole patents as the only prior documents referred to in the opinion as anticipating the patent in suit. There are two of these patents, Nos. 777,273 and 777,274, referred to in the opinion. They are United States patents, although they are erroneously described in the opinion as British patents. Patent No. 777,273 (printed R., pp. 647–652, * p. 1190) fully describes the Cattermole process. Patent No. 777,274 describes a specific improvement not itself important herein. Both patents plainly and clearly disclose a metal sinking process, summarized in No. 777,273 as follows:

> " ground or pulped ore is caused to be violently agitated, as by a revolving stirrer, in a mixture of water and oil, the liquor being acid. As the agitation proceeds the particles of metalliferous matter agglomerate together and may be observed in the form of granules,

> the size of which will depend, among other things, upon the percentage of oil used. * * * In practice a continuous process is used—that is to say, water, ground ore, or pulp and oil, * * * are continuously fed into a series of vessels, and the products of the agitation are continuously fed into an up-current separator * * * which * * * separates the metalliferous granules from the gangue by allowing them to fall to the bottom of the vessel * * * while the particles of gangue are carried away by an upward stream" (R., p. 648).

This description is substantially repeated in No. 777,274 (R., p. 654). Not only is the metal recovered by increase of its falling power in water, but nothing that either floats or is carried upward by an up-current of water is separated from the gangue or sand, since the gangue or sand is carried upward by this up-current of water. By violent agitation of the ore pulp and oil the metal is coated with oil and the metallic particles are agglomerated together into granules. Then the pulp flows into a separator wherein an up-current of water is maintained. The granules of metal particles stuck together by oil sink against this up-current. The gangue or sand or rocky particles are carried upward by this up-current and thus separated from the metal particles. Should any metal particles not sink against the up-current they will be carried away with the gangue. The process of concentration—of separation from gangue—is a complete failure as to every particle which floats or is carried upward by the up-current. This is the Cattermole process as clearly disclosed in the patents as above noted and as used in practice in Australia for a few days, after years of research and experiment in London, England, and after the construction in Australia of a plant calculated to treat 100 long tons of ore per day (R., Chapman, pp. 183–186).

The opinion of the Circuit Court of Appeals says, as to the Cattermole process :

> "there are two distinct steps in the treatment of the ore—there is first a violent agitation to cause the oil to gather up the metalliferous particles, as in the case of other oil flotation processes. Then follows a slow, smooth stirring of the mass, which releases the air

from the froth or scum and causes the oil and metalliferous particles to adhere together and form granules of sufficient size and weight to sink, after which the mass at the bottom is drawn off, and the particles of sand and gangue therein are forced upward and thus separated from the granules of metal" (R., p. 718).

This is a fanciful reconstruction of the Cattermole process. In fact, as above explained, separation in an upcast immediately follows the violent agitation, so that if a floating froth were produced by the violent agitation it would all go to waste with the gangue, unseparated therefrom. The slow, smooth stirring is a suggested alternative procedure for certain ores in some stages of the process for increasing the size of the granules. We quote from the specification as follows:

> "With certain ores it may be preferable to use in some stages of the process a rolling form of agitation, as in cylinders or barrels, to obtain good granulation of the mineral" (R., p. 651).

This suggestion was carried out in practice by first violently agitating, then separating in an upcast, then slowly stirring the concentrates that had sunk in the upcast and then separating in another upcast, and as thus carried out everything that floated or was carried upward in the first upcast after the first and violent agitation went to waste with the gangue (R., pp. 185, 186). Obviously, therefore, the opinion of the Circuit Court of Appeals is wholly erroneous in its statement that the violent agitation produced a froth carrying the metal. It did not and does not produce a froth in the Cattermole process.

Associated with this confusion as to the actual operations in the Cattermole process is the statement in the opinion of the Circuit Court of Appeals that the quantity of oil used in the Cattermole process approximates the quantity called for by the patent in suit (R., p. 718). This is founded upon the fact that the oil proportion recommended in the Cattermole patents is based upon the amount of metallic material (described as "metalliferous mineral" or "mineral") present in the ore and ignores the fact that the Cattermole patent No.

777,273, which alone fully describes the process, cautions the user

> " where but *little mineral is present in the ore*, to increase the nucleating or granulating factor pulverized mineral matter obtained in a previous operation or other matter having an affinity for oil from a different source may be introduced into the ore, or a portion of already granulated and separated mineral matter may be returned to *maintain the necessary amount of mineral* in the ore under treatment " (R., p. 651 ; italics ours).

Obviously, therefore, the plain directions of the patentee are that for any ore not containing the necessary amount of metallic matter—a lean ore or possibly even an average ore—the amount of metallic matter must be increased, or material having an affinity for oil added, and thereby the oil proportion increased. The evidence is that the Cattermole process was only used for a rich ore and that the lowest oil proportion used in this process, either in the laboratory or in practice, was 1½% of the ore (R., Chandler, p. 382 ; Higgins Report of March 2, 1905, p. 445). It is also proved, both by the defendant and the complainants, that when the process of the patent in suit is carried on in practice, an increase of oil above the proper proportions for that process is indicated by the appearance of Cattermole phenomena—the nucleating of the metal particles into granules which sink and are lost with the gangue in the tailings (R., Gibson, p. 75 ; Chapman, pp. 195, 196, Qs. 110, 111).

Thus the rule of law which eliminates the other prior documents held to be anticipative needs hardly to be invoked as to the Cattermole process, since its principles of operation are plainly so directly opposite to those of the process in suit. It may be generally noted, however, that an essential difference in principles of operation differentiates each and every one of the prior disclosures from the process in suit, as will appear in the full consideration hereinafter to be given to these prior documents.

One other prior process is, however, referred to in the opinion of the Circuit Court of Appeals, the Elmore process ; and the argument founded thereon involves substantial error as to all of the prior documents held to disclose anticipations,

and as to the earlier thereof direct conflict with the British judgments above referred to. This subject will now be considered.

Errors of Law and Fact of Circuit Court of Appeals and Conflict With British Judgments.

The errors of law and fact of the Circuit Court of Appeals in so far as applied to the Cattermole patents have been considered. As to other prior documents referred to in the opinion, there are plain errors of law and fact in the interpretation and legal effect of the prior disclosures, in conflict, in every instance wherein the document is prior to the Elmore patents, with the reasoned judgments of the British courts as to the force and effect of these disclosures. In the consideration of these errors we will first explain the Elmore process which was the process sued upon in the British suits.

The Elmore process is a metal flotation process which relies upon the unassisted buoyancy of a notably large amount of oil to float the metallic particles. The metallic particles are selected, entrapped and floated by a large quantity of thick oil, so that the surface of the water is covered with a layer of oil within which the metallic particles are held by the viscosity and tenacity of the oil. There are two Elmore patents referred to in the opinion of the Circuit Court of Appeals. The first, No. 676,679 (printed R., pp. 608-611, * pp. 1136, 1137), fully describes this process, and the second, No. 689,070 (printed R., pp. 612-614, * p. 1142), repeats the description, adding the use of an acid to enhance the selective action of the oil. This process has the distinction of being the only prior metal flotation process of those referred to in the opinion of the Circuit Court of Appeals which ever went into use. It was to some extent successful in practice, although its use was abandoned long before the process of the patent in suit was invented (R., Ballantyne, pp. 213, 214). The amount of oil used was from 2,000 to 6,000 pounds per ton of ore, depending upon the richness of the ore (R., Chapman, p. 197; Chandler, p. 368). This process was referred to in the opinion of the Court of Appeals, not as anticipative of the patent in suit, but for the purpose of demonstrating that the disclosures of the other

prior documents could not have been processes which relied exclusively upon the buoyancy of oil to float the metal (R., p. 720). This, however, did not need to be demonstrated, as it involved a misconception of the arguments for complainants, and was altogether beside the point. The disclosures of these prior documents in so far as they were intended to be flotation processes, were not usable in practice, largely because they did not embody the characteristics of the Elmore process which made it a usable process. They are divisible into two classes, those preceding Elmore (Haynes, Everson and the Criley and Everson publication), which do not definitely or at all disclose metal flotation processes, and those following Elmore and embodying efforts to improve upon Elmore's flotation process by employing less oil. All were alike failures—unusable and unused schemes of operation.

These disclosures preceding Elmore were also considered in the two British judgments above referred to, and there is a marked conflict between the conclusions of the ten Law Lords who participated in these judgments (the former Lord Chancellors Viscount Haldane, Lord Loreburn and the Earl of Halsbury, and Lords Ashbourne, Atkinson, Shaw, Dunedin, Parker, Sumner and Parmoor) and the opinion of the Circuit Court of Appeals brought before this Court for review.

The complainants' patents in these British suits were the British and Australian Elmore patents, substantially corresponding to the second United States Elmore patent above referred to, No. 689,070 of 1901. The defendant's process alleged to infringe was the process of the patent here in suit.

In the Haynes British patent No. 488 of 1860 (R., pp. 523–526), flotation of the metal is not disclosed nor suggested, and it was then unknown in the art. It describes mixing the ore with an oily agent to form a doughy or pasty mass, and then working the doughy mass in water and thereby squeezing out some of the gangue. The patent was set up in the Answer but discarded by all of defendant's witnesses and not urged by defendant until the argument in the Circuit Court of Appeals.

The Everson patent No. 348,157 of 1886 (R., pp. 579–583) likewise does not disclose or suggest flotation of the metal. Its principal disclosure, or first method, wherein the use of about five per cent. of oil is recommended, is the Haynes pasty

mass or pudding process, with the addition of acid " to cut the sand away from the otherwise cohering mass " (R., p. 581). A modified process, the second method, using about 18 per cent. of a thin oil, is described as the reversal of the then and now well known water concentration or wet separation process, utilizing the difference in sinking power between gangue and metal, wherein the lighter sand or gangue is carried upward and off in suspension in a current or flow of water which will not carry upward the heavier metal particles. By the use of oil the metal particles were sufficiently coated and mixed with oil to make the mixture lighter than the sand, so that it could be carried off in suspension in a current of water which would not carry off the now heavier particles of sand. The specification describes thorough agitation of the oily mass in water to effect detachment of the sand and then removal of the concentrate from the sand by a constant overflow of water from a washing-out vessel, and then says :

> " Devices and methods now well known in wet separation of ores will be suited to this part of the operation, bearing in mind that the sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil, and acid " (R., p. 582).

This lightening of the metal by entrapment in oil produces a specific gravity of the mixture of oil and metallic particles which is lower than sand but higher than water (R., p. 355). This mixture of oil and metal will not float to the surface of the water because it is heavier than water, but it will be carried off by a current of water which will not carry off the heavier sand particles. When material, which sinks in water, is carried off by a current of water in a state of suspension in the water, it is not unusual, nor is it strictly incorrect, to say that it is " floated off." This is what Everson said in her specification (R., p. 582), immediately before the description above quoted which exactly explains what she meant. Everson diminished the sinking power of the metal but did not float it. True flotation of the metal up and through the surface of the water is an impossibility according to the disclosures of this patent, is not required by its scheme of operation, and is not disclosed. Froth is nowhere mentioned or suggested.

The Criley and Everson publication in the Engineering and Mining Journal of November 15, 1890 (R., p. 415) is not a definite disclosure. Defendant's expert did not refer to it, although on cross-examination he admitted that he was familiar with it (R., p. 125, x-Q. 88). This article fails to give any such instructions as will enable the operation referred to to be repeated, and is best summarized in the Privy Council judgment above referred to, wherein it is said that the attention of their Lordships was directed in considerable detail to this article, its description is quoted in full, and it is said:

> "Even if the test process is not to be discarded as a failure, it does no more than give information that if to a greased mixture of pulverized metal and rock you add boiling sulphuric acid in a sufficient quantity of water, in some way a differentiation is effected as between the metal and the gangue" (R., pp. 749, 750).

The name "Everson" and the use of oil and acid are the only clues connecting this article with Carrie J. Everson whose patent has just been considered. The absence of any statement as to the amount of oil used makes it impossible to affirm or deny that there was sufficient oil for oil-buoyancy flotation. The Privy Council held that the disclosure was not sufficiently definite to anticipate the Elmore process, and its conclusions as to the extent of the disclosure eliminate it as anticipative of the process here in suit.

The Privy Council judgment considered the Haynes British patent, the claims of the Everson patents and the Criley and Everson publication, and rejected them as anticipations of the Elmore bulk oil and oil-buoyancy flotation process, and likewise rejected them as in any way affecting the question of infringement of Elmore by the process of the patent here in suit. Of the Haynes British patent it said:

> "Haynes' patent, published in 1860, describes a method of separation of metal from gangue by the use of an agent containing fatty or oleaginous matter. This document, is, however, not more than an indication of the date at which attention was first directed to the affinity of oil for metals, and does not affect the novelty of the invention claimed" (R., p. 749).

The invention claimed was the Elmore bulk oil and oil-buoyancy flotation process. Obviously the Law Lords of the Privy Council failed to find a disclosure of metal flotation in the Haynes patent.

In the Privy Council case, which originated in Australia, only the claims of the Everson patent were considered. They had been published in Australia and the full specification had not been published there. In the House of Lords case against the patent on which judgment was finally rendered, which originated in England, the full specification and claims of Everson were considered. The Criley and Everson publication was not properly pleaded in the House of Lords case and was therefore not considered therein. This appears in the summary near the beginning of the Privy Council judgment, paragraphs 2 and 3 (R., p. 748).

The Everson patent is repeatedly referred to in the House of Lords' judgment (Appendix to Petition for Writ of *Certiorari*, pp. 41–62). The Law Lords who decided this case evidently did not consider the disclosure of the Everson second method as sufficiently definite to be worthy of consideration as an anticipation. Every reference in this judgment is to Everson's first method, wherein the mixture of oil and metal was a stiff mass. Lord Loreburn held that the Elmore patent was so wide in its claim that it included "any mixture whether in a stiff mass or in a flowing pulp" (*idem*, p. 45), and therefore held that the Everson first method anticipated the Elmore patent. The Earl of Halsbury concurred in the Lord Chancellor's judgment, but additionally held that there was no infringement of the Elmore patent by the process of the patent here in suit, saying: "the acidulation which is supposed to incriminate" the process of the patent here in suit "is common to the" Elmore process "and to another which was invented and patented before it"—clearly the Everson process, as appears from the following statement: "I do not propose to deal with these propositions since I entirely agree with what the Lord Chancellor has said on the subject" (*idem*, p. 46).

Lord Ashbourne then merely stated: "I concur" (*idem*, p. 48).

Lord Atkinson found non-infringement of the Elmore patent by the process of the patent here in suit by reason of the

limitations imposed upon the Elmore patent by the Everson patent. He stated three variant constructions of the Elmore patent (1) wherein there is no limitation to quantities or consistency of the component parts, (2) wherein the mixture is in the condition of a freely flowing pulp, or (3) wherein the oil floats the metal by the buoyancy of the oil (*idem*, p. 50); and says that, upon the first construction, the Elmore patent is anticipated by the Everson patent; that the Elmore claim cannot receive the second construction, and that, upon the third construction, there is no infringement (*idem*, p. 51). The failure to mention the Everson patent as anticipative of the second and third constructions shows that the Everson patent was not deemed to clearly disclose a freely flowing pulp and was not deemed to disclose metal flotation.

Lord SHAW also reaches the conclusion of non-infringement, after giving the most elaborate consideration to the specification of the Elmore patent (*idem*, pp. 54–57) and to the specification of the British patent No. 7,803 of 1905 to Sulman, Picard and Ballot, which corresponds with the patent here in suit (*idem*, pp. 57–61). He further says, however, that had the Elmore patent admitted of a construction broad enough to include any mixture of ore, oil and water and productive of varieties of results, he would have been inclined to hold that it was anticipated by the Everson patent (*idem*, p. 61).

Thus the Law Lords wholly rejected the Everson patent as disclosing metal flotation, although giving it full force and effect as anticipative of any such broad construction of the Elmore patent as would include a process not of metal flotation.

Turning from the accurate and careful views of the ten Law Lords who participated in the judgments above referred to, to the opinion of the Circuit Court of Appeals herein, we find the argument presented that the prior patents and publication immediately above considered must of necessity have described a froth process because they did not describe enough oil for oil buoyancy. Relative to these patents the following statements are made:

> " The Haynes' patent uses 11 per cent of oil to the ore, and directs that the mixture be agitated with hot, warm or cold water * * *. The Everson patent de-

> clares that thorough agitation of the mass or pulp, comprising water, the finely divided ore, the oil of fat and the acid, is necessary, and in the Engineering and Mining Journal of November 15, 1890, there is an article describing a test operation of that process, in which it was said that as the result thereof 'a thick scum of sulfurets rose to the surface and was skimmed off, leaving the hitherto black ore as white as snow; in fact, pure silica'" (R., p. 720).

The principal error of this argument is the assumption that whenever in the prior art ore, water and oil were agitated and mixed, necessarily a metal bearing froth rose to the surface and such a froth production represented a practical operation of concentrating ores—an error largely based upon ocular examination of defendant's deceptive court-room experiments; but the coupling up of the Criley and Everson publication with the Carrie J. Everson patent without any authority in the evidence, and the assumption that because this publication said that a certain result was produced without giving any understandable instructions as to how it could be produced, it was to be accepted as evidence of the carrying on of a process which would produce that result, is strongly in contrast with the precise and accurate conclusions expressed by the Law Lords in dealing with the identical subject-matter in a substantially similar relation.

The Schwarz and Kirby secret applications were later than Elmore, and were, therefore, not considered in the British judgments. In the opinion of the Circuit Court of Appeals it is said:

> "The Schwarz United States patent No. 807,503, applied for in May, 1904, and granted in December, 1905, describes a process in which the dry ore is first mixed with enough oil to make a thick pasty mass, and water is thereafter added, and the mass is agitated so as to cause the metallic particles to float" (R., p. 717).

This "thick pasty mass" requires, as the evidence shows, from 30 to 50 per cent. of oil (R., Chandler, p. 367; Liebmann, p. 330).

In the opinion of the Circuit Court of Appeals it is then stated :—

> " The quantity of oil to be used is not further specified, but it is in the testimony that the Schwarz process has been experimentally used with cottonseed oil, the quantity used being 3.6 per cent. of the ore treated " (R., p. 717).

It is true that defendant's expert, Dr. Byrnes, made an experiment which he designated as the carrying out of the process of the Schwarz patent, and that in this experiment he used 3.6 per cent. (three and six-tenths per cent.) of cottonseed oil, but he did not have the temerity to state that he thereby formed a thick pasty mass of the ore and oil, but said that he obtained " a homogeneous mass having the consistency of molding sand (R., p. 106).

In criticism of this experiment Dr. Liebmann testified, as to the oil and ore mixing operation :—

> " The result had the consistency of molding sand, *i. e.*, of an almost dry powder. The patent directs you that you are to have a thick, pasty mass " (R., p. 277).

Again Dr. Liebmann says :

> " Schwarz makes first a paste of his ore and oil * * * and then blows air or gas through pipes into this paste. To be able to do this, he must at least use a quantity of 50% of oil, or 1,000 lbs. to the ton of ore " (R., p. 330).

Dr. Chandler testifies :

> " Dr. Byrnes described an alleged Schwarz test, but as he only used sufficient oil to give the mixture of oil and ore the consistency of molding sand, which is a slightly damp sand, it is quite certain that he did not follow the directions of Schwarz and did not produce a thick pasty mass of such consistency that it would acquire sponginess when air was blown in it " (R., p. 367).

Professor Chandler then describes an effort to carry out a Schwarz experiment with oil in the proportion of 30 per cent.

of the ore, which was wholly unsuccessful, and then an increase of the amount of oil to 50 per cent. of the ore, which produced operations such as the Schwarz patent called for, although it was a failure as to the concentration of ore (*idem*). Obviously the statement in the opinion of the Circuit Court of Appeals that the evidence shows the Schwarz process was experimentally used with 3.6 per cent. of oil is an error of fact, although even if it were true, and if it were true that Schwarz produced an oily frothy floating mass with such a percentage of oil, the Schwarz patent would wholly fail to disclose the process of the patent in suit. Schwarz tried to improve upon Elmore and indefinitely suggested some improvement in oil economy, and his disclosure was both unusable and unused in the practical art of concentrating ores.

Relative to the Kirby secret application filed December 14, 1903, upon which a patent issued No. 809,959 on January 16, 1906, the specification gives a full and elaborate description of an effort to improve upon Elmore by using a thin oil, such as kerosene, in the recommended proportions of from 25 to 75 per cent. of the ore, or from 500 to 1,500 lbs., of oil to the short ton of ore, and proposes to assist the flotation of the hydrocarbon-coated or oil-coated particles by the injection of air, since "Some of the hydrocarbon-coated particles will float to the surface without assistance; but a considerable quantity of such particles will not be sufficiently buoyant" (R., p. 673). Obviously oil-coated particles which will float to the surface without assistance must do so in accordance with the Elmore principle of oil buoyancy. Obviously also, with less oil than Elmore, a considerable quantity of such particles will require assistance, and Kirby planned to assist these particles to the surface by the attachment of air bubbles to these heavily oil-coated metallic particles. His scheme of operation was a total failure, spoiled by too much oil, but he did not know and the art did not know that the reduction of the oil to the minute and critical proportions characterizing the process here in suit, would bring into effect a new and different mode of operation which the mere presence of more than the critical minute quantity of oil would destroy.

It may be generally noted, also, both as to Schwarz and Kirby, that these patentees describe special and peculiar

apparatus for carrying out their processes, and that the operations disclosed are plainly dependent upon the use of such peculiar apparatus. Nevertheless the defendant made no effort to construct such apparatus, and defendant's expert in his experiments alleged to be the carrying out of Schwarz and Kirby used a special machine known as the slide machine, invented by Messrs. Sulman and Picard in 1909 as a test apparatus for the process of the patent in suit, this machine being the most modern and efficient mineral froth producing apparatus known to the art.

The British courts not only decided that the process of the patent here in suit was essentially and totally different from the Elmore oil-buoyancy process, but with a knowledge of all the disclosures of the art prior to Elmore, said that the defendant's process, the process here in suit, was a new method of separation. In the House of Lords judgment the Earl of Halsbury said, referring to the Elmore process and the agitation froth process here in suit:

> "My Lords, I am of opinion that the two inventions are essentially different. I mean by the two inventions those which might be technically described, the one upon the selective action of oil, the other upon surface tension. That the two processes are in these respects totally different cannot be denied" (Appendix to Petition and Brief, p. 46).

Again Lord Shaw said of the defendant's process there (the process of the patent in suit here):

> "they are not promoting a method of separation which had before been described, but they are engaged upon *a new method of separation.* Instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid" *(idem,* p. 59; italics ours).

Lord Shaw then gives consideration to the defendants' process as described in the British patent corresponding to

the patent in suit here, and then as to the question of infringement by that process of the Elmore patent says:

> " nor do I see my way to hold that there has been any contravention of the 1901 patent by the application of the acid to a mixture in which the oil has been reduced from bulk to the merest fraction, and especially when froth instead of oil has been secured, along with the law of capillarity or surface tension, as the main floating and separating agent " (*idem*, p. 60).

Again in the House of Lords' decision Lord Atkinson says of the process of the defendant there (the process of the patent in suit here):

> " in their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles, which, introduced into the mixture by the more or less violent agitation of it, envelop or become attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water " (*idem*, p. 51).

In the Privy Council judgment the theory of the new mode of operation which was introduced by the process of the patent here in suit received careful consideration in the light of the then existing knowledge of the peculiar and still mysterious conjoint operation of air bubbles and a minute quantity of oil. We quote as follows:

> " The real difficulty which their Lordships have to to determine is whether the Respondents in the process of separation which they employ, entrap or coat and hold or carry the metallic particles in oil, using oil as the selective agent. The Respondents deny that they in any way use the Appellants' invention, and say that their process is essentially distinct, and that its successful operation depends on the law of surface tension. It is not incumbent on the Respondents to explain the law

on which the success of their process depends" (R., pp. 754, 755).

* * * * * *

"Apart from any question of theory, the Respondents use oil in their process under conditions which make it almost impossible to entrap or coat and hold the metallic particles by the selective agency of oil. The Respondents use a thin oil at a temperature of 120° Fahr., the quantity is minute, not more than 2 or 3 pounds to a ton of ore, or about 2 or 3 pints of oil to 10,000 pints of water; the resulting concentrate is practically free from oil and no mechanical contrivance to separate the oil from the metallic particles is required or used; the residue of the first concentration is further treated without any further addition of oil" * * * "their Lordships accept the evidence of Professor Pollock (defendant's expert) * * * summarized as follows: Professor Pollock is referred to his earlier evidence, and states that he does not think that the small quantity of oil introduced in the Defendants' process necessarily performs any other function than *permanency in the froth and extremely minute emulsion.* He allows that there may be oil in excess, and that some of the particles may get oiled, but states that this is entirely and absolutely unessential. He does not however think that more than the necessary quantity of oil is introduced to effect concentration, but that having regard to the nature of the problem it is a matter of conjecture, and exact calculation is not possible. Finally, he reiterates his opinion that the Defendants' process can be accounted for without assuming selection of the metallic particles by oil" (R., pp. 755, 756; italics ours).

These theories of Professor Pollock which were accepted by the Privy Council as to the function performed by the minute proportion of oil used in the agitation froth process, are acceptable to-day and upon the record herein, and it is only necessary to add to them the fact that the minute quantity of oil, besides performing the function of maintaining "extremely minute emulsion" and producing "permanancy in the froth" or persistency of the air bubbles, coats the metal with a film so attenuated as to be almost infinitesimal, and mysteriously acts so as to increase the mutual attraction of the air bubbles and metallic particles and to cause them to persistently hold together in the rush

and swirl of the agitation and until the froth has overflowed from the surface of the liquid and separately delivered the metallic particles; and that this operation takes place notwithstanding the fact that any substantial increase in the oil proportions above the critical minute proportion required with a given oil for a given ore destroys the operation of the process and produces a useless mode of operation approaching that of Cattermole in that the metallic particles tend to stick together and sink.

The conclusion of the British courts that the novelty of the invention resides in selection and flotation by air bubbles, is accurate and is as fully warranted by the evidence in the case at bar. The British courts had before them the Elmore patents and all of the art prior to Elmore, out of which had come only the Elmore process as a practically usable process, and of which Elmore contained the only disclosure of flotation-concentration. The later art failed to attain flotation-concentration of ores. The process of the patent in suit attained flotation-concentration of ores by air bubbles, and the patent in suit disclosed to the world the pioneer usable process of flotation-concentration by air bubbles. The patent in suit is therefore entitled to broad construction dominating this new art which its invention created—flotation-concentration by air bubbles.

Judge BOURQUIN, in his opinion in the case at bar, aptly describes the process in suit (R., p. 21) as

> " flotation by air introduced by vigorous agitation "

which produces

> " a froth of oil and metallic particles and air bubbles "

with

> " so little oil it disappears, is not sensible to sight or touch upon the concentrates, but only to analysis."

And Judge BOURQUIN says as to the novelty of the invention (R., p. 23):

> " The process in suit is so clearly new that no exhaustive discussion of facts, cases or law is necessary to distinguish it from other processes or to demonstrate its novelty."

As contrasted with the concurring opinions of the British courts as to the novelty of the "new method of separation" of the agitation froth process with its new principles of operation, and the opinion in the case at bar of Judge BOURQUIN, before whom the case was elaborately presented, in harmony with the conclusions of the British courts, the Circuit Court of Appeals for the ninth circuit found that the admitted novelty of the process of the patent here in suit in the minuteness of the quantity of oil used, was mere economy in oil, "a difference of degree and not of kind" (R., p. 719) and based that opinion largely upon the illustrations of the prior art and of the process of the patent in suit made by the defendant in aid of the argument before the Circuit Court of Appeals (R., pp. 720, 721). The history of the discovery and invention of the process of the patent in suit, established as it is by three sets of contemporaneous documents, will be fully considered hereafter under the heading "History of the Invention," and the plain errors of fact in the opinion of the Circuit Court of Appeals as to what the record shows relative to that discovery and invention will be there considered.

Patent in Suit.

The patent in suit is reprinted in the record (R. pp. 475-480, *pp. 944, 945), but as the original line numbers have been lost in this reprint, a double reference will be made to the pages of the record herein and to the lines and pages of printed Patent Office copies of the patent which will be supplied at the argument.

The specification of the patent in suit fully and completely discloses the invention and gives to the public the best knowledge possessed at the time of the filing of the patent application of the means for utilizing the invention, as abundantly appears in the record. The important point as to discovery is truthfully stated to be that the inventors had found that a considerable reduction of oil from that required for the Cattermole granulation or metal sinking process brings about the new process which the patent in suit discloses and claims. The principal Cattermole patent No. 777,273 is briefly described (R., pp. 475; specification, p. 1,

lines 16–22), and then the Cattermole improvement patent No. 777,274 is briefly referred to (specification, p. 1, lines 23–27). Then follows the statement of the historically established facts as to the discovery of the new process.

> " We have found that if the proportion of oily substance be considerably reduced—say to a fraction of one per cent. on the ore—granulation ceases to take place, and after vigorous agitation there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum " (Spec., p. 1, lines 28–35).

The various factors upon which the new process is dependent are then set forth. First it is stated that

> " the water in which the oiling is effected is preferably slightly acidified " (Spec., p. 1, lines 37, 38).

This preferential factor was not included in claims 1, 5, 9, 10 and 12 of the patent in suit, but is included in all of the other claims in issue, claims 2, 3, 6, 7 and 11, and the defendant uses it.

Again it is stated that the process is assisted if the pulp is warmed (R., p. 476, Spec., p. 1, lines 51–56). This factor of assistance to the process was not included in claims 1, 2, 5, 9, 11 and 12, but was included in the other claims in issue, claims 3, 7 and 10, and the defendant uses it.

The last factor stated is the fine pulverization of the ore, and this is not only an important factor, but a very great advantage of the invention. The finer the ore is ground, the more certain is it that the mineral and the gangue shall be in separate particles. Fine grinding is therefore *per se* a great advantage. But fine grinding means a great quantity of slimes or extremely fine particles such as are necessarily produced in a grinding operation which reduces all particles to at least a maximum size far exceeding that of the slime particles. These slimes, instead of being wasted as in other processes, are utilized—concentrated—and the valuable constituents of the slimes are saved. With all fine grinding and especially with brittle minerals such as zinc sulphide or blende, this concentra-

tion and saving of the slimes with the larger particles are of prime importance. Indeed, the new process will deal with slimes alone, if necessary, a reject from all other processes now in use, and will take out the valuable mineral from pure slimes, as has been demonstrated by actual work in Australia. The part of the specification referring to the utility of slimes is as follows:

> "The formation of froth is assisted by the fine pulverization of the ore, and we find that slime mineral most readily generates scum and rises to the surface, while larger particles have less tendency to be included in the froth" (R., p. 476, spec., p. 1, lines 56–61).

The factor of "fine pulverization" is illustrated in the later description of a specific example of the carrying on of the process with a particular ore, to wit, the Broken Hill ore of Australia in the treatment of which the invention was first put into practical use, and it is said that

> "if the ore were crushed to ninety mesh to the linear inch (half of which ore will pass through one hundred and fifty mesh sieve)" (R., p. 476, spec., p. 1, lines 102–104)

the first froth obtained from a single operation of agitation and settlement "may contain about seventy per cent. to eighty per cent. of the metalliferous matter present in the ore" (Spec., p. 1, line 105, p. 2, line 1). This was an exact description of what took place in the tests made following the discovery of the new process. Bearing in mind that ninety mesh to the linear inch would mean about one one-hundred-and-eightieth of an inch, and one hundred and fifty mesh about one three-hundredths of an inch, it will be seen that this is very fine crushing and that a crushing which produces particles having a maximum diameter of the larger size first mentioned produces particles at least one-half of which will pass through openings one three-hundredths of an inch in diameter. All of the claims properly define the ore as "powdered," and as wet crushing is usual in the art, the powdered ore is produced either as a wet powder or as a powder held in suspension in water, forming an ore pulp.

In processes of ore concentration of wide application, such as is the process of the patent in suit, a great variety of different ores has been and will be encountered, each ore being in some particulars different from every other ore. This fact was recognized in the opinion of Judge BOURQUIN, who lives in the mining town of Butte, Montana, and we quote from his opinion as follows:

> "It is true, every ore presents its own problem of reduction. So while all may lend themselves to a general method, each may require some modification of the method. All skilled in the art understand this, and know that in addition to the best scientific theory they must add the light given by trial and practice. Thus, only, in the majority of cases, is good, and the best results obtained in any ore reduction, smelting, milling or concentration" (R., p. 23).

The statement of the specification in recognition of the fact that each ore presents its own problem and that the determination of the critical oil proportions characterizing the new process requires simple preliminary tests intelligently conducted, is as follows:

> "The proportion of mineral which floats in the form of froth varies considerably with different ores and with different oily substances, and before utilizing the facts above mentioned in the concentration of any particular ore a simple preliminary test is necessary to determine which oily substance yields the proportion of froth or scum desired" (Spec., p. 1, lines 61–69).

The manner of conducting such simple preliminary tests, as they are being made every day in the laboratory of the complainants, and for that matter in the laboratories of the licensees, since every plant includes a laboratory to guide and check the larger operations of the mill, is described in the evidence (R., Chapman, pp. 191, 192). It will be noted that this description closes with the statement:

> "The greatest amount of oil that I have ever used in practice is 4 lbs. per ton of ore, and the smallest amount I have ever used in practice is one pound of oil per ton of ore" (R., p. 192).

This testimony refers to the English long ton of 2240 lbs. and the percentages are .17 per cent. (seventeen hundredths of one per cent.) and a trifle over .04 per cent. (four hundredths of one per cent.). The minimum of the latest practice in Australia is .9 pounds of oil per long ton of ore (R., p. 247), exactly .04 per cent. (four hundredths of one per cent.). This range includes all of the many applications of the new process with various oils and various ores in the treatment of millions of tons of ore. The remarkable fact is that these variations have no relation to the richness of the ore, since the rich Broken Hill ore of from 50 to 55 per cent. metalliferous mineral content (R., p. 370 ; p. 185) required originally two lbs. of oil to the long ton of ore (R., p. 187), and later refinements reduced this oil consumption to 1½ lbs. per long ton (R., p. 194) and the latest practice, with a variation in the particular oil mixture used, requires from .9 to 1.3 lbs. per ton of ore (R., p. 247). On the other hand lean Braden ore, 3 per cent. copper, requires 4 lbs. of oil per ton of ore (R., p. 196), the ore and oil here being wholly different. It may be added that the particular oil used is determined largely by cost at the concentration plant, locally produced oils being frequently given the preference. What would be a suitable oil in the Braden plant in Chile, might be of prohibitive cost at Broken Hill, Australia, or Orijarvi, Finland, or Butte, Montana.

The specification follows this general statement as to the necessity of simple preliminary tests, with a full description of an example of the application of the invention to a particular ore, to wit, Broken Hill ore, with the use of the oil oleic acid (Spec., p. 1, lines 70 *et seq.*). This well known ore is described (R., Chandler, p. 69; Liebmann, p. 318) and it is the ore which was under treatment when the process was discovered and invented, as well as that on which it was first used in practice. The recommendation in this description as to oil proportion is 0.1 per cent. (one-tenth of one per cent.) of the ore which, it is said, " has been found suitable and economical " (Spec., p. 1, lines 96–101). It may be noted here that the tests made at the time of the discovery of the invention determined that this proportion of one-tenth of one per cent. gave the best results, although slight variations up and down from this proportion were not altogether useless.

Therefore we find that the specification suggests the range of proportions for Broken Hill ore and with oleic acid as the oil "(say from 0.02 to 0.5 per cent. on the weight of the ore)" (Spec., p. 1, lines 80–82). These tests are described herein under the heading "History of the invention—Discovery." In subsequent applications of the process to the treatment of millions of tons of ore these limits have never been exceeded with any oil or any ore.

The description of the application of the process to Broken Hill ore describes the operation as conducted in a simple and well known apparatus, to wit:

> " a cone mixer or the like, as in the processes previously cited " (Spec., p. 1, lines 83–85).

The processes previously cited are those disclosed in the two Cattermole patents referred to earlier in the specification. No. 777,273 shows two batteries of cone mixers (R., * p. 1190) and No. 777,274 refers to Cattermole patent No. 763,260 for apparatus, and this latter patent has a drawing identical with that of No. 777,273 (R., * p. 986) and was founded upon the same application of which its application was a division (R., p. 505).

The " cone mixer " is the so-called Gabbett completely shown and described in Gabbett United States patent No. 444,345, January 6, 1891 (R., pp. 481–484, * p. 958) and in the corresponding British patent No. 840 of 1889 (R., pp. 527–532, * p. 1015), and which has been manufactured and sold from 1890 up to the present time and very extensively advertised (R., pp. 244, 245, * pp. 1058–1062), so that it has been since 1889 and 1890 one of the well known mixing devices of the art. This well known mixing device is here described as a single piece of apparatus in which the brisk agitation is first carried on and then the agitation is stopped and the mineral froth rises to the surface. In such simple form it is not illustrated, and obviously it did not require illustration, since it was a well known device. This mixing apparatus is, however, generally illustrated as part of more complicated apparatus designed for continuous operation in the two drawings of the patent in suit (* pp. 944, 945), and the well known detail of stationary baffles invariably used when the vessel is

in round or cylindrical form (R., p. 245) is not illustrated, it being noted, however, that this omission is common to the three Cattermole patents (* pp. 980, 986, 1190) which illustrate the Gabbett, and to all except the very first advertising illustrations of the Gabbett (* pp. 1061, 1062) as well as to other illustrations of the Gabbett in other patents of the complainants (* pp. 1228, 1232).

Full directions for agitation in this well known cone mixer are given. A time measure for the period of agitation is given

> " two and a half to ten minutes " (Spec., p. 1, lines 85, 86).

and another qualifying measure of the time of agitation is given in the statement that the agitation is to be carried on

> " until the oleic acid has been brought into efficient contact with all the mineral particles in the pulp " (Spec., p. 1, lines 86–88).

Then follows the statement :

> " When agitation is stopped, a large proportion of the mineral present rises to the surface in the form of a froth or scum which has derived its power of flotation mainly from the inclusion of air-bubbles introduced into the mass by the agitation, such bubbles or air-films adhering only to the mineral particles which are coated with oleic acid " (Spec., p. 1, lines 89–96).

Thus the fact that the flotation is produced by the adherence of air-bubbles to the very lightly oiled mineral particles is fully and clearly set forth in the specification. In the light of the knowledge of the present day we can only positively say that the flotation is produced by air-bubbles, functioning in the presence of the minute oil proportions specified in the patent and not otherwise, and that these air-bubbles adhere only to the metallic or mineral particles, which are coated with oil, but with a coating so attenuated that it cannot be seen or felt, and its presence is provable only by chemical analysis.

The operation is concluded by the removal of the mineral froth. The specification says :

> "This froth is removed from the pulp by spitzkast, upcast, skimming, draining, or otherwise" (Spec., p. 2, lines 1–3).

Removal by (1) "skimming" may be accomplished by skimming the froth from the surface of the liquid in the agitation vessel during the state of quiescence that follows the violent agitation. The froth may also be separated by (2) "draining" out the liquid contents of the vessel through an opening in the bottom, leaving the mineral froth alone in the vessel, or by adding more liquid and causing the froth to overflow, as was done in the process of the patent in suit when first carried out in the cone mixer of Gabbett as above described. Removal by (3) "spitzkast" requires that the contents of the agitating vessel shall flow into a spitzkasten (a vessel with a pointed bottom particularly adapted for ore pulps) from which the froth may be flowed off at the top ; and this has the advantage of permitting continuous operation. It is the method used by the defendant herein, and used in all of the concentrating plants of the complainants and their licensees at the time that the testimony was closed herein. Removal by (4) "upcast" may be carried on by an upcast or upcurrent of air or water to assist the froth in floating over a lip or dam. Slight upcurrents of water are provided for in a specific froth-separating apparatus described later in the specification (R., p. 477 ; spec., p. 2, lines 74–76). This apparatus was used in practice with such slight water upcurrents, but it was found that even these slight upcurrents were unnecessary (R., Sulman, p. 136). Thus we have four alternative methods specifically suggested for completing the separation of the mineral from the gangue, all of which are usable and one of which has been used by the defendant. Obviously, however, the means employed may be such as best suit the conditions at any plant. Claims 1, 2, 3, 5, 6 and 7 are limited only to separating the froth by flotation or its equivalent, while claims 9, 10 and 11 do not specify anything in this regard except "separating the froth," and claim 12 says "separating the froth from the remainder of the mixture."

The specification at times refers to the froth as a "scum" and as a "froth or scum." The word froth exactly describes what is produced by the process fully described in the specification, and this is the only word used in the claims (which point out the invention) in describing the aggregation of mineral covered air bubbles which forms upon and above the surface of the liquid. The word scum does not very well describe the clean metal froth inevitably produced by following the directions of the specification. This froth is well described by the witnesses. Mr. Chapman, whose experience had included tests in the laboratory of all prior metal concentrating processes known in England (R., pp. 182, 183), describes the froth produced in the first commercial plant carrying out the process in suit, installed by him in Australia in 1905 (R., pp. 186, 187) as follows:

> "This was entirely different to any float that I had seen in the other processes in which flotation had been attempted. This froth had many characteristics, and the most important difference I noticed in comparison with the other floats was that the froth was of the same color as the mineral and of the same lustre. This had never been so in the other cases, where the oil had considerably dulled the natural color and lustre. The froth consisted of air bubbles, with water films that were highly charged with sulphide mineral. These bubbles could not retain their natural spherical shape, owing to the crowding together of the froth mass. The upper layers of bubbles, when they broke, deposited their charge of mineral on to the bubbles beneath. This gave the froth a pitted or scoriated appearance. The depth of the froth at the point of overflow was quite three inches. The froth was so coherent and substantial that it would readily support a coin, which it would carry over the overflow lip without breaking through the mass. We used this to demonstrate to visitors at a later date" (R., pp. 186, 187).

Dr. Liebmann, a chemist and physicist of international reputation, also describes the froth of the rich zinc ores which he tested as "a froth of very peculiar character," as follows:

> "It is a froth consisting of air bubbles, which in their covering film have the minerals embedded in such manner that they form a complete surface all over the

air bubbles. The remarkable fact with regard to this froth is that, although the very light and easily destructible air bubbles are covered with a heavy mineral, yet the froth is stable and utterly different as far as this property is concerned from any froth known to me. It appears as if the minerals were protecting the tender air bubble like an armor, and, instead of destroying it, were actually guarding it. The froth has a long life. One feels tempted to say it is permanent, at least as far as metallurgical operations are concerned" (R., p. 253).

Again Dr. Liebmann says:

> "The result, as I have mentioned above, is an absolutely new phenomenon, of which I could not find anywhere in literature an analogue. According to my knowledge, it is the first time that a froth is described which behaves like a bubble of air enclosed by a sheet of metal. It actually has the properties of an air bubble enclosed in such a manner" (R., p. 255).

Dr. Charles F. Chandler, who has educated more mining engineers than any other man and has been called upon to testify in all the principal metallurgical controversies for the past forty years, also describes this froth first produced by the process in suit (R., p. 382). At the conclusion of this description he says:

> "The oil has entirely disappeared from sight and sense. It cannot be seen and it cannot be felt, and the particles of mineral are just as bright as though there was no oil upon them at all" (R., p. 382).

The process having been fully described and a specific example having been given of a complete procedure for carrying it out in practice, we have now reached a point in the specification of the patent in suit from which we may pass to the claims in issue. The remainder of the specification, from page 2, line 3, to the claims, merely describes features which are the subject-matter of claims not in issue, apparatus which forms no part of the invention (since the invention, as claimed, is a process), suggested re-treatment of the tailings by agitation, which is not an inventive addition to what has already been

described, since it is doing over again the same thing, and suggested re-treatment in modified apparatus and with modified details of procedure, these modified details of procedure to some extent forming the subject of other patents not in issue. Dr. Chandler in briefly explaining the specification does not go beyond the point just reached (R., pp. 50–52), and the court need go no further. But as defendant's counsel has found material for criticism in later parts of the specification, the remainder of the document will be explained.

Commencing at page 2, line 3 of the specification (R., p. 476, last four lines), there is a description of a subsequent chemical treatment of the concentrates for the removal of minute microscopic coatings of oil upon them, the method described being that of changing the oil oleic acid to a soap by a caustic alkali, thus producing a substance, in fact soft soap, which will readily dissolve in the water. This procedure, while quite practicable, has never been used in practice. The amount of oil is so small that it is not worth while to recover it, and the coating is so attenuated that it does not interfere with any subsequent physical treatment of the concentrates. For example, at the Saxbergets concentrating plant in Sweden the concentrates were passed through magnetic separators for the removal of worthless iron compounds and then over shaking tables for separating the zinc and lead—

> " This series of retreatments were conducted on the concentrates without any special preparation. The small quantity of oil on these concentrates rendered this unnecessary " (R., Chapman, p. 194).

As pointed out in the opinion of the ninth circuit Court of Appeals, claim 13 of the patent (which is not in issue) includes removing the oleic acid by treatment with an alkali (R., p. 721),and it may be added that it is also included in claims 4 and 8, which are not in issue ; and the opinion calls attention to the fact that in one of the documents contemporaneous with the invention one of the inventors said that the recovery of the oleic acid was " a necessary step in rendering the concentrates fit for vanning, separation into blende (zinc) and galena (lead)." Upon this the assertion is made that the inventors did not know one of the advantages of the invention immediately after it had been made. Obviously it is

no valid criticism of an invention that the inventors having made it, and having fully described how to carry it on, did not immediately know all of its advantages. Further, although removal of the microscopic traces of oil from the metallic particles has not heretofore been necessary because it does not interfere with any physical operations, it may well be necessary if and when the concentrates are to be subjected to a subsequent chemical treatment, such, for example, as by the well known cyaniding process, in which the presence of even this minute amount of oil would be objectionable, and the disclosure of this simple method of chemically removing this trace of oil would then be utilized in preparing the concentrates for cyaniding.

Next in the specification commencing at page 2, line 9 (R., p. 477, line 1), is described an alternative method of introducing the oleic acid in the form of soap, which is an oleate or salt of this fatty acid, and readily dissolves, and then decomposing the soap by sulphuric acid so as to liberate the oil oleic acid *in situ* in the pulp, in accordance with the principles disclosed in the prior patent to Cattermole and others, No. 777,274, referred to here and also referred to at the beginning of the specification. This also is the subject of claims not in issue (claims 8 and 13), and is of no importance in this controversy.

Next, commencing at page 2, line 13 (R., p. 477, line 4), is the statement of the possibility that the fatty acid which forms the microscopic coating on the "metalliferous matter which produces the froth" may give rise to insoluble soaps, if soluble lime, iron or other salts are present in small quantity during the production of the froth or on the breaking down of the froth with alkali as above referred to, and that if this happens it will not be of disadvantage to flotation. This relates to oil recovery by alkali, and to possible results of such procedure when the liquor is used over again in closed circuit, and is of no importance in this controversy.

Thereafter we have descriptions of supplemental treatments or retreatments for the recovery of metalliferous matter not recovered in the first froth, but except in so far as they describe retreatment by agitation, as is common in this new art, they need not be considered. In all prior efforts of these patentees to solve the problem of effective and economical

oil concentration of ores, it had been necessary to provide for supplemental treatments by different processes. The inventors had thus become accustomed to such procedure, and although they had now invented a process, and had fully disclosed it in their specification, to which retreatment by other processes was not a necessary adjunct, they possibly did not then fully realize the great value of their invention and its superiority to any other process for treatment and re-treatment until the practicable maximum of concentration has been attained. Nevertheless, the re-treatments by other processes which they describe are feasible and practicable, although not as useful in the majority of instances as re-treatment by the agitation froth process, which they also describe.

The first of these supplemental treatments is by table flotation on shaking tables or the like, and is as stated described in an earlier application of the same inventors "Serial No. 246,637, filed February 20, 1905" (Spec., p. 2, lines 37–39). This application, filed one month before the process here in suit was invented, matured into patent No. 879,985, granted February 25, 1908 (printed R., pp. 693–697, * pp. 1242–1245). It is not a froth process, but is a film flotation process wherein an oiled mineral is exposed to air and then floats on the surface of water by reason of its repulsion of the water, as in the case of the floating greased needle.

Then follows this statement:

> "The proportion of mineral recovered in the froth and that recovered by table flotation may be considerably varied; but, generally speaking, the froth will separate the slime mineral while the larger particles are recovered by the latter method" (Spec., p. 2, lines 40–45; R., p. 477, third paragraph).

This statement clearly suggests, that, with elimination of larger particles, which is possible with finer grinding, all of the metalliferous mineral may be recovered in the froth (R., Liebmann, p. 310). In 1905 fine grinding was the bane of the millman and its resulting slimes his source of greatest trouble. The inventors, although they recommended very fine grinding, were to some extent dominated by the then existing practice of the art, and while they clearly recognized the fact that their

new process would concentrate the slime mineral and said so, they did not quite dare to assume that a procedure so directly contrary to the existing practice would be adopted in the mills.

The specification then refers to the drawings, in which Figure 1 is described as

> " a diagram in perspective illustrating one form of apparatus suitable for carrying this invention into practice " (Spec., p. 2, lines 47–49 ; R., p. 477),

and Figure 2 is not described as a diagram, but as a drawing which

> " represents in perspective an apparatus for carrying out a secondary step in the process " (Spec., p. 2, lines 49–51).

This distinction between the two illustrations is accurate. Figure 2 shows to a large extent new forms of apparatus. Figure 1 shows merely a rearrangement of old apparatus, to wit, a Gabbett or cone mixer A, an ore feed apron D and hopper C, a pump R, a circuit liquor heater S, heated by gas jets S^1, a succession of spitzkasten J^1, J^2, J^3, and a filter Q. The

> " mixing vessel A (of which there may be any number in series) " (Spec., p. 2, lines 52, 53 ; R., p. 477)

is described as

> " the frothing apparatus A " (Spec., p. 2, lines 62, 63),

and the spitzkasten J^1, J^2, J^3, as

> " the froth-separating apparatus " (Spec., p. 2, line 66).

The complete process of froth formation and separation as carried on in this particular arrangement of apparatus, in which the contents of the frothing apparatus are discharged " on the surface of a current of water running over columns of water " (Spec., claim 13, p. 4, lines 36, 37 ; R., p. 480) forms

the subject of claim 13 of the patent in suit, and this claim is not in issue. The details of this arrangement of apparatus and the specific modification of the process carried out in it are therefore not relevant in this suit. It may be noted, however, that although only a single cone mixer is shown, the specification says "there may be any number in series" (Spec., p. 2, line 53; R., p. 477) as above stated, and referring to the prior patent to Cattermole No. 777,273 earlier referred to in the specification of the patent in suit, we see a battery of four of these cone mixers in series. It should also be noted that this apparatus is intended to be used continuously, and, therefore, the cone mixer is not drained from the bottom, but from the side, and a swan-neck drain pipe is provided which extends up so that the contents of the vessel cannot be drained off faster than the pulp is supplied to the vessel. Like most continuously operating apparatus, this apparatus is unfitted for intermittent use. At this point it is interesting to refer to "Sulman drawing accompanying report May 3, 1905" (R., * p. 1047), since this is a drawing made by one of the patentees promptly after the apparatus diagrammatically represented in Figure 1 of the patent in suit had been constructed and tested and is another diagram of the same apparatus (R., Sulman, pp. 135, 136).

The apparatus shown in Figure 2 of the patent in suit is for use in what is called a superaeration treatment of the pulp, utilizing the attraction of air bubbles by the liberation of air within the pulp in the presence of a minute quantity of oil in accordance with the process disclosed in this patent in suit, but specifically by forcing the air into solution under considerable pressure and then relieving the pressure, with the result that bubbles of air are liberated throughout the body of the liquid and

> "at once sweep to the surface thereof all the metalliferous matter in the form of a froth" (Spec., p. 2, lines 113–115).

This superaeration mode of operation forms the subject of a later application filed by the same inventors "on January 9, 1906, Serial number 295,326" (Spec., p. 2, line 119; R., p. 478), which matured into patent No. 835,479, issued November 6, 1906 (printed R., pp. 684–686, * p. 1232), simultaneously

with the patent in suit. It will be noted that there is a long description of this superaeration mode of operation in the patent in suit, from page 2, line 103, to page 3, line 34, but that most of this description and Figure 2 of the drawings were inserted by amendment pursuant to a demand of the Patent Office Examiner that the apparatus for this procedure be fully shown and described (R., p. 566, Pat. Off. Letter Aug. 9, 1905; R., pp. 567, 568, Amendment filed April 17, 1906). This modification of the process is described in the patent in suit as a method for the recovery of any sunk oiled metalliferous matter which may be deposited in the second and third spitzkasten (Spec., p. 2, lines 103–106; R., p. 478), and it is also described as "alternative" (Spec., p. 2, line 103) to

> "further treatment by agitation" (Spec., p. 2, lines 86, 87; R., p. 477).

The latter has proved to be the most effective and economical method of retreatment, although table flotation was tried for a time in the first plant carrying out the process of the patent in suit. Agitation and froth separation are repeated to the maximum limit of practical results in metal recovery in the world wide and extensive use of the invention by the licensees of Minerals Separation, Limited, as well as in the infringing plant of the defendant.

Patent in Suit—Claims.

The claims in issue are 1 to 3, 5 to 7 and 9 to 12 (R., p. 61), ten of the thirteen claims of the patent. They are quoted by Dr. Chandler in analytical arrangement and then briefly compared (R., pp. 53–55).

It is the duty of a patentee to "particularly point out and distinctly claim the part, improvement of combination which he claims as his invention or discovery" (U. S. R. S., Sec. 4888). This the patentees have done. The invention or discovery is the series of acts constituting the new art or method of procedure discovered by the patentees and applied by them to the concentration of millions of tons of ores, largely dumps and waste products, the reject of prior processes. The scope of the claims is as broad as the

invention, and the claims point out and delimit, in varying scopes and with varying limitations, the essentials of processes embodying the new idea of means constituting the invention. As defined by this court:

> "A patentable invention is a mental result. It must be new and shown to be of practical utility. Everything within the domain of the conception belongs to him who conceived it. The machine, process or product is but its material reflex and embodiment" (Smith v. Nichols, 88 U. S., 112, 118; opinion by Mr. Justice SWAYNE).

Claim 1 is as follows:

> "1. The herein-described process of concentrating ores which consists in mixing the powdered ore with water, adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of one per cent. on the ore), agitating the mixture until the oil-coated mineral matter forms into a froth, and separating the froth from the remainder by flotation."

This claim points out the essentials of the simple procedure the performance of which is the "material reflex and embodiment" of the invention. The essential small proportion of an oily liquid having a preferential affinity for metalliferous matter is defined as amounting to a fraction of one per cent. of the ore, and the fraction of one per cent. recommended in the specification is one-tenth of one per cent.

Claim 2 adds to claim 1 that the water shall be "slightly acidified."

Claim 3 adds to claim 2 "warming the mixture."

Claim 4 is not in issue.

Claim 5 includes the specific oil oleic acid in a small proportion here defined as amounting to from one fiftieth to one half of one per cent. of the ore. These limits were set as the result of the initial tests of the invention, and they have not been exceeded—in fact have never been reached—in the practical applications of the invention, with oleic acid or any other oil, to a wide variety of ores. In other respects the claim is substantially the same as claim 1.

Claim 6 adds to claim 5 the use of sulphuric acid in the proportion of a fraction of one per cent. of the water.

Claim 7 adds to claim 6 "warming the mixture to 30°—40° Centigrade" (86° to 104° Fahrenheit). That the defendant has not succeeded in avoiding even this specific claim in using oleic acid with a zinc ore, is evidence of the definite character of the new process protected by the patent.

Claim 8 is not in issue.

Claim 9 is the broadest claim. The amount of oil is stated to be "a small quantity". The process is stated to include "coating the mineral with oil in water containing a small quantity of oil, agitating the mixture to form a froth, and separating the froth". The essentials of agitation of the ore in powdered form diffused in water in the presence of a small quantity of oil so as to form a froth and thereby to utilize air bubble separation, are set forth, as well as the completion of the operation of concentration or separation by separating the froth. The novelty of the invention as thus defined is unquestionable. Conditions may well arise in the future wherein the critical oil proportion is increased by reason of a useless absorption of the oil within the pores of a gangue material, or wherein an oil or a mixture of oils is employed having unusual characteristics, as a result of which the critical oil proportion may be one per cent. or slightly more. Under such conditions this and the two following claims may be necessary to protect the invention.

Claim 10 adds "warming the mixture" to claim 9.

Claim 11 adds to claim 9 the use of "a quantity of acid insufficient to cause chemical action on the metalliferous mineral present." The metalliferous mineral is the valuable metal or sulphide of metal to be concentrated, and the limit as to acid proportion is such as will not decompose this metalliferous mineral. The ore may contain, as all Broken Hill ores do, a small quantity of a gangue material, such as calcite or limestone, which will be decomposed on contact with sulphuric acid, and thus will uselessly consume sulphuric acid so that an excess of sulphuric acid must be added to assure the physical action of the acid which is alone useful in the process. Such a possible and unavoidable chemical action is not excluded from the claim.

Claim 12 is like claim 1 except that, as in claims 9, 10 and

11, it does not specify that the final separation of the froth of oil-coated mineral shall be effected by flotation. It specifies the essential froth formation by agitation (air-bubble separation) and then merely "separating the froth from the remainder of the mixture." Like claims 1, 2 and 3, it specifies that the amount of oil shall be a fraction of one per cent. of the ore. Obviously this claim and claims 9, 10 and 11 provide against the contingency that the ingenuity of an infringer may devise some method of separation to which the word "flotation" appearing in claims 1, 2 and 3, might not be applicable.

It is the duty of the patent attorney to draw claims as broad as the new idea of means—the mental concept—constituting the invention, as well as claims pointing out the details of the particular embodiment of the invention in which the inventors have carried it out. The efforts of infringers during the seventeen year term of the patent to use the invention and yet escape the claims of the patent, should be so far as possible anticipated and rendered nugatory. The patent attorney's duty has been well performed in this instance and the claims are commensurate with the invention.

Patent in Suit—File-Wrapper and Contents.

The defendant has put in evidence a certified copy of the file of the patent in suit (printed R., pp. 558–572). This is the record of the proceedings in the Patent Office which resulted in the grant of the patent, and it became a public record when the patent was issued in accordance with the usual practice. Being a record of the proceedings which satisfied the Patent Office as to the patentability of the invention, it is informative to the court. It shows that the Patent Office Examiner, as a result of his search against the patentability of this invention, did not cite any prior patent or publication whatever against any of the claims of the patent, which were allowed substantially as filed, and that the only claim against which references were cited was an indefinite claim which did not point out the essential air-bubble separation of the process in suit. This claim was claim 12 of amendment

filed April 17, 1906 (R., p. 569, cancelled claim 12), and it was rejected in the Patent Office letter of June 18, 1906 (R., p. 572). This claim was as follows:

> "12. The process of concentrating powdered ore which consists in separating the minerals from gangue by coating the minerals with oil in water containing a fraction of 1% of oil on the ore, and recovering the oil-coated minerals."

The rejection was as follows:

> "Claim 12 is rejected in view of 763,260 Cattermole, June 21, 1904; or 793,808, Sulman *et al.*, July 4, 1905, * * * as expressing merely a difference of degree thereover as to the proportion of oily matter employed."

Thus we have here the Examiner's opinion that a claim which specified

> "coating the minerals with oil in water containing a fraction of 1% of oil on the ore"

specified a different and necessarily smaller quantity of oil than either of the two patents cited as references, and that this difference, although conceded to exist, was merely a difference of degree when not associated with air-bubble separation. This moreover was the opinion of one of the trained experts of the Patent Office peculiarly familiar with the patents and literature of the art.

These two cited patents are for processes of the complainant, Minerals Separation, Limited. The first, Cattermole, No. 763,260 (printed R., pp. 505-510, *p. 986) claimed that modification of the granulation or metal sinking process employing oil emulsions instead of straight oil, and recommended the quantity of oil to be used as "from four per cent. to six per cent. of the weight of metalliferous mineral matter present in the ore" (R., p. 507), and provided for the enrichment of lean ores by the addition of metalliferous mineral or otherwise increasing the amount of oil used by adding material having an affinity for oil whenever the necessary amount was not originally present in the ore (R., pp. 508, 509). The second of these patents, No. 793,808

(printed R., pp. 659–662, *pp. 1204–1208), represents the first unsuccessful efforts of Sulman & Picard to utilize flotation in ore concentration with a smaller quantity of oil than was required in the Elmore oil-buoyancy flotation process. The application for this patent was filed October 5, 1903, during the early struggles of Messrs. Sulman, Picard & Ballot to discover or devise a satisfactory process of ore concentration by oil. The quantity of oil to be used is stated to be

> "insufficient to raise the oiled mineral by virtue of the flotation power of the oil alone" (R., p. 659).

That is to say, it is something less than a minimum of 2,000 pounds to the ton of ore; and it is also stated to be such that the solid particles are

> "moistened by oil" (*idem*).

To moisten the particles requires at least the Cattermole quantities, which were the smallest quantities known to be usable in 1903, and the minimum of which was 1¼% of the ore. It is a characteristic of the process in suit that the minute quantity of oil used disappears from sight and touch. The Examiner was entirely right in his statement that this claim, which was differentiated from every other claim by its omission of any reference to agitation or froth production, was differentiated from the prior art by the limitation of the quantity of oil to a fraction of one per cent. He was also right in his rejection of this claim. It did not sufficiently define the invention.

It may be noted that in the opinion of the Circuit Court of Appeals under review an erroneous conclusion is drawn from the above action of the Patent Office, it being said that the Patent Office ruled that the applicants could not "take from others the right to use oil economically" (R., p. 723). Obviously what the Patent Office held was that mere economy of oil *per se* was not patentable and that the applicants *could* take from others, for the limited life of the patent, the right to use a new process invented by them one new feature of which was the minuteness of the quantity of oil used. The Patent Office was in agreement with the Circuit Court of Appeals as

to the novelty of the minuteness of the quantity of oil used, but wholly disagreed with the Circuit Court of Appeals as to the patentability of the new process of which this novelty was one feature.

In the prosecution of an application for a patent, it usually happens that many alterations are made in the claims. As it has been expressed, the specification and claims are then in a plastic condition and may be molded so as to best describe and claim the actual invention in the light of the prior patents discovered in the Examiner's search. In the application for the patent in suit, not a single claim involved in this controversy was altered in substance, and only three claims, claims 5, 6 and 7, were altered in language. This alteration was by inserting "a fraction" in place of "less than" before "1% of sulphuric acid", the Examiner suggesting that less than one per cent. might mean "water without a trace of sulphuric acid" (Patent Office Letter November 23, 1905, R., pp. 566, 567), and also suggesting the expression "a fraction of one per cent.", which was adopted.

It will be noted that the disclosure of the invention, except as to the superaeration modification, remained absolutely unaltered even in language throughout the prosecution of the application, and that the description of the superaeration modification was made pursuant to a requirement of the Patent Office (Patent Office Letter August 9, 1905, R., p. 566), resulting in the addition of Figure 2 to the drawing and a necessary description thereof (R., pp. 567, 568).

History of the Invention.

The evidence proving the history of the invention was largely brought out by the defendant on an open commission issued at his request to take testimony in London, England (R., pp. 125–127). The three inventors voluntarily appeared and were successively examined by the defendant; and their metallurgist, Mr. A. Howard Higgins, who had under their directions conducted the crucial experiments, also voluntarily appeared and corroborated their testimony. Thus the presumptions of the patent were strengthened by the evidence in behalf of the defendant.

The evidence thus adduced by the defendant was largely documentary—original reports and letters written from time to time as the work progressed—proof of a high character. The history of the period preceding and contemporaneous with and immediately following the invention is largely outlined in twelve reports of Messrs. Sulman & Picard to Mr. Ballot, addressed to him individually before the organization of the company, and to him as chairman of the Cattermole Ore Concentration Syndicate, Limited, during the period when that company was the controlling organization, and to him as chairman of Minerals Separation, Limited, after the present complainant had been incorporated, these reports covering a period from March 25, 1903, to May 3, 1905; and in two reports of Mr. Higgins of March 2, 1905, and March 16, 1905 (the date of the invention being between March 3 and March 10, 1905, as fixed by letters from Mr. Ballot to Australia of those dates).

The reports of Messrs. Sulman and Picard dealt with the work of all three inventors. As Mr. Sulman testifies:

> "No matter how closely we collaborated and how intimately all the experiments were known to those concerned, Mr. Ballot always insisted upon such results being put into complete form as a record of work done, and this was always carried out by us" (R., Sulman, p. 144, x-Q. 156).

And again Mr. Sulman says, particularly referring to the report of March 3, 1905, which records the specific instructions pursuant to which the discovery was made:

> "In a report dated March 3, 1905, made by Sulman & Picard and addressed to John Ballot, was recorded the work which the whole three of us were doing then, and this report was not so much for the information of Mr. John Ballot as the putting on record of work which he and we had jointly done, for purposes of reference afterwards" (R., Sulman, p. 130).

The two reports of Mr. Higgins describe the work done by him under the instructions of the three inventors, as testified to by himself, as well as by the three inventors. The first

report was made immediately before the discovery of the process (R., p. 131, Q. 34), and the second report shortly after the discovery (R., Sulman, p. 132, Q. 35).

Other original letters written at the time also appear in the evidence. These documents were all brought out during defendant's testimony, marked for identification, submitted to defendant and his counsel for examination, and copies supplied as requested (R., p. 181, Commissioner's note), but in accordance with the usual equity practice, their formal offer as evidence was postponed until the taking of complainants' rebuttal testimony, and then such of them as had not been sufficiently copied in the record were offered in evidence as complainants' exhibits.

History of the Invention—Research Period Preceding Discovery.

During the year 1902 and succeeding years, until March, 1905, when the process of the patent in suit was discovered, Messrs. Sulman, Picard and Ballot were at work upon the Cattermole metal sinking process (R., Ballantyne, p. 214), as indeed fully appears in the reports themselves. During this period of two and one-half years they carefully investigated and improved the Cattermole metal sinking process and carried it to the stage of installation in Australia. As their work proceeded they were troubled by the occasional flotation and consequent loss of small portions of metallic matter. This was so troublesome that special apparatus was devised to sink this floating material (R. Higgins, p. 181, x-Q. 141; Sulman, pp. 127, 128; Picard, p. 153).

Although floating metal was a source of trouble when the aim was to recover the metal by sinking it, it was not treated as something to be avoided in the concentration of ores, but it was investigated and efforts were made to utilize it as early as July, 1903, when Messrs. Sulman and Picard invented the process disclosed in their patent No. 793,808, in which the aim was to recover the metal by flotation as a film on the surface of water of metallic particles brought to the surface by air or gas bubbles and left floating at the surface by the bursting of the bubbles on their emergence

from the liquid. This process, although never developed to any utility, was patented, as aforesaid. It was useless because the amount of oil used was so large that the attraction of the air bubble for the metallic particle was very nearly destroyed. The process was first tested by generating a gas in the pulp in the presence of a heavily oiled mineral and in this form was originated and tested by Messrs. Sulman and Picard in July, 1903 (R., Sulman, p. 128; Picard, p. 148; Ballantyne, pp. 222, 223). In August, 1903, through the publication of the British patent to Froment No. 12,778 of 1902 (R., Sulman, p. 128; Ballantyne, pp. 222, 223) they learned that this idea of floating oily flocks of metallic particles by bubbles of gas chemically generated had been anticipated by Froment. It was this circumstance which induced them to purchase the Froment patent and all improvements thereon made by Froment.

Another form of this process of floating heavily oiled flocks of metallic particles was the use of a slowly revolving worm immersed in the pulp to force air into the pulp. This is disclosed in the Sulman & Picard patent No. 793,808 and is described in the testimony (R., Ballantyne, p. 223; Chapman, p. 183).

Another flotation process produced collaterally during this work on the Cattermole metal sinking process was that which is disclosed in the Cattermole, Sulman & Picard "Soap and Flotation Patent" No. 788,247 (R., Sulman, p. 142, Q. 143). The patent is, however, merely for the application of the soap phenomenon to all that was known when that invention was made of the flotation of metals. It is hereafter fully described (*infra*, pp. 133, *et seq.*).

These processes invented early in 1903 are not referred to in the reports covering this period, it being noted that these reports, of May 5, 1903, and September 24, 1903, differ from all others in that they were entitled "Cattermole process" (R., pp. 423-425), thereby indicating that they are limited to the work done on that particular process, and do not include other investigations. The first reference in the reports to any effort to utilize flotation appears in the report of March 4, 1904. This was an incident of the completion of an experimental Cattermole metal sinking plant which Mr. Chapman took with him to Australia in April, 1904, for the purpose of testing it there and erecting there a large commercial plant to

carry on the Cattermole process. The apparatus thus constructed is shown in the photograph " Complainants' Exhibit Photograph Australian Cattermole Plant " (R., * p. 951, facing p. 480). The original photograph is in evidence identified by Mr. Sulman (R., p. 144) and Mr. Chapman (R., p. 184, Q. 8). The apparatus consisted of three tiers of Gabbetts or cone mixers with intervening upcasts in which the granulated metal which sunk was recovered and in which all the material which either floated or was carried up by the up-current went to waste. It was used as the model for the construction of the larger plant in Australia, this plant having a capacity of treating 100 long tons of ore per day (R., p. 185), but in this plant the lower tier of Gabbetts was omitted. A few experiments were reported utilizing this lower tier of Gabbetts in the treatment of the waste product from the upcast following the second tier of Gabbetts. These experiments are described in the report under the heading " Flotation Factor Used " (R., p. 431). It clearly appears, however, that what was thus described as flotation was merely the upward movement of stickily oiled metallic particles with an up-current of water in an upcast. The oil proportion was " 3.8% of oil on mineral " (R., p. 430, last two lines). The ore was " Broken Hill ore " (R., p. 430), further described as " Broken Hill ore ' straight ' " (R., p. 429) and therefore of from 50% to 55% mineral content, so that the minimum amount of oil used was 1.9%, or nearly 2% of the ore. The concentrates recovered by this tail end treatment of metallic matter oiled in Cattermole proportions were only 2.6%. There was undoubtedly fast agitation and some beating in of air, but the conditions had not yet been assembled for the discovery of the process here in suit, and this experiment and another one following it with the same quantity of oil (R., p. 431, Run No. 4) made by the inventors just one year before they discovered the process in suit, developed nothing of any practical value. In the last of these two tests an effort was made to utilize the flotation ideas of Messrs. Sulman & Picard which had been patented by Froment, in that " a little carbonate of lime " (R., p. 432) was added. This in the presence of sulphuric acid caused the generation of the gas carbon dioxide, but the " concentrates obtained, 1.6% " were not particularly encouraging. We there-

fore find that in the next report dated April 19, 1904 (R., p. 433) four days after Mr. Chapman had sailed for Australia taking with him the experimental Cattermole plant (R., p. 435) further work on a duplicate of that plant was supplemented by vanning experiments on shaking tables such as had been known and used for years in the wet concentration or gravity separation of ores (R., pp. 433, 434). In conjunction with these tests carbonate of lime was used and the effort continued to utilize the phenomenon patented to Froment. These and following experiments resulted in the abandonment of the Froment idea, as appears in the report of May 18, 1904, as follows:

> "We have been able to clean up nearly all the contained oiled mineral, and to produce sharp clean sands without the use of any gas producing carbonate, etc., thus effecting considerable economy both in acid and carbonate" (R., pp. 438, 439).

This marked the final abandonment of the effort to use the Froment idea in the only field in which it had given indications of usefulness, to wit, the cleaning of Cattermole tailings. It proved inferior to the more simple table-flotation process invented by Messrs. Sulman, Picard and Ballot and patented in patent No. 879,985, one of the patents referred to in the patent in suit. It was abandoned for this new and simple method of floating the tailings over a shaking table so as to produce film flotation of the metal.

In the report of May 2, 1904, temperature tests are described (R., p. 437) marking the first effort to utilize heat in the Cattermole process. The results were unsatisfactory, but further investigation was suggested "at some future time" (R., p. 437, line 4 from bottom).

In the meantime Mr. Chapman was proceeding diligently in Australia with the work of installing a commercial plant having a capacity of 100 long tons of ore a day for carrying out the Cattermole process (R., pp. 185, 186). He duplicated the smaller plant, but omitted the third or lower tier of agitators and replaced them by modified shaking tables

> "to recover by skin flotation any mineral flocks which had been lost with the gangue product" (R., p. 186).

He further testifies:

> "This plant was completed and adjustment runs made in or about April, 1905. * * * The oil consumption alarmed our clients, and I was instructed to use every endeavor to bring this down. This was only possible to the extent of .8% of the weight of the ore. The formation of good shotty granules was impossible under these conditions, mineral flocks being formed, and these readily separated on the skin flotation table. * * * The plant proceeded to run on these lines" (R., p. 186).

It will be noted that this effort by Mr. Chapman to economize oil consumption by spoiling the Cattermole process and producing a hybrid skin or film flotation process was carried on one month after the invention of the process here in suit, but in the Antipodes and in ignorance of the discovery of the process in suit, as will later appear. But even this use, subsequent to the present invention, with oil in the proportion of a large fraction of one per cent. of the ore, did not produce the floating froth, for had it been produced it would have gone to waste in the first upcast with the gangue slimes. That recoveries were obtained on the tables sufficient to justify the running of the plant shows that the metal sank in the first upcast. Later, when the process here in suit was communicated to Mr. Chapman through the course of the mails, in June, 1905, he welcomed it as a discovery of great value (R., p. 186, Q. 23) and immediately reconstructed the plant so as to utilize it, by discarding the upcasts, replacing the second tier of mixers by a spitzkasten, and treating the tailings from the spitzkasten by the shaking table arrangement already installed (R., p. 186, Q. 24). His description of the result, a floating froth in the spitzkasten

> "entirely different to any float that I had seen in the other processes in which flotation had been attempted" (R., p. 186, Q. 24)

is of interest. The shaking tables were soon discarded and the tailings which were found to contain "potential froth" (R., p. 187) were agitated by dropping them with a splash and the froth recovered in a second spitzkasten. The proportion of "2 lbs. of oleic acid per long ton of ore" (R., p. 187) was used,

and the process of the patent in suit employed throughout in the recovery of the valuable metals. The work thus started has continued, and millions of tons of ore have been treated.

The experimental work in London proceeded slowly towards the assembling of the factors which resulted in the discovery of the process of the patent in suit. There was "about six months' interregnum" (R., Sulman, p. 137) in that work, arising from the fact that all efforts were concentrated upon the installation of the commercial plant in Australia, but in the report of February 17, 1905, attention is called to the great advantage of moderate heat in the Cattermole granulation process, the excellent results in the large tests in Australia being attributed to the higher temperatures prevailing there; and a series of tests is recommended to "quantify the heat effect more accurately" (R., pp. 440, 441).

In the next report, of February 21, 1905, it appears that emulsions have been discarded and oleic acid used alone (R., p. 444, lines 1-3) and that Mr. Higgins will carry out a series of Gabbett tests

> "in order to determine the best combined time and temperature factor for Broken Hill ore used with straight Oleic acid" (R., p. 443).

These factors of the use of straight oleic acid and heat were essential contributions to the discovery which followed shortly thereafter, but the inventors were still working on the Cattermole process, having tested and rejected all flotation methods known in the art prior to the discovery of the process in suit except the film or skin flotation of heavily oiled metallic particles produced by a table flotation supplement at the tail end of the Cattermole process. Their tests had demonstrated that this film flotation, recovering small quantities in floating films, was the only kind of flotation then known of any practical value, and was useful only for recovering metals from the dirty sands rejected by the Cattermole process. This is a historical fact established by the contemporaneous documents in evidence.

History of the Invention—Discovery.

In the next Sulman and Picard report of March 3, 1905, we find a summary of the work then being done at the Minerals Separation laboratory as the determination of the influence of seven factors on Cattermole granulation. The seventh of these factors is "influence of the amount of oil on granulation" (R., p. 447). This was the last factor as a part of a scheme of investigation, carried on under definite instructions, which, as to the amount of oil, were to "reduce the oil as far as possible", "to find the lowest limit at which results could be obtained by the use of oil" (R., Higgins, p. 180, last three lines), which resulted in the discovery of the process in suit. Defendant therefore probed deeply into the facts as to this investigation and proved that these instructions were the result of a conference of the three inventors, Messrs. Sulman, Picard & Ballot, and were written out by Mr. Sulman and handed by him to Mr. Higgins in the presence of Mr. Ballot (R., Sulman, p. 130, *p. 260; p. 138, Qs. 100–104; Picard, p. 149, *p. 299; Ballot, p. 167). Mr. Ballot says:

> "Relative to the program of work set for Mr. Higgins by Messrs. Sulman, Picard and myself, this program was prepared by us in writing and was handed to Mr. Higgins by Mr. Sulman in my presence" (R., p. 167).

It further appears that as to the seventh factor the actual instructions were to reduce the quantity of oil "step by step" (R., Ballot, p. 167), so as to find "the lowest limit at which results could be obtained by the use of oil" (R., Higgins, p. 180, last two lines). The work of Mr. Higgins under the supervision and direction of the inventors with all the factors that had been assembled in the researches of more than two years and a half as to the Cattermole process, and under particular and explicit instructions to reduce the oil step by step and note the results, brought about the discovery of the process of the patent in suit.

As to prior work Mr. Higgins testifies:

> "Q. 44. In adjusting the oil to give the best granulation, I presume you experimented with different quantities of oil.
>
> "A. Yes, there may have been different quantities, but whenever the granulation became imperfect by reason of the drop in the quantity of oil, the oil was naturally increased" (R., p. 176).

Mr. Higgins' testimony, given in behalf of the defendant, fully corroborates that of the inventors. He says:

> "The first occasion upon which I ever saw the phenomenon of an oiled concentrate, the bulk of the concentrate, floating as a scum or froth upon the surface of a pulp, was while carrying out a series of experiments at the instructions of Messrs. Sulman, Picard and Ballot in the early part of March, 1905. These instructions were given to me by Mr. Sulman and their nature was to carry out a series of tests on the factors influencing granulation" (R., p. 177).
>
> * * * * * *
>
> "The instructions which I received from Messrs. Sulman, Picard and Ballot, pursuant to which I carried out the experiments described in my report of March 16, 1905, were, so far as they related to the quantity of oil, to start with large quantities of oil, say the upper limit of Cattermole's specified quantity, and reduce this as far as possible. In other words, to find the lowest limit at which results could be obtained by the use of oil" (R., p. 180).

The above mutually corroborative testimony of the three inventors and their metallurgist, is further corroborated by by that of their agent Mr. Ballantyne, who was then in daily conference with Messrs. Sulman, Picard and Ballot. Mr. Ballantyne says:

> "I remember in the early part of February, 1905, having a conference with Messrs. Sulman, Picard and Ballot, at which they spoke of the investigations which they were about to make, and we discussed the method in which the results were to be indicated; and I particularly remember these gentlemen stating to me that in their investigations they were going to reduce

> the proportion of oil used in the Cattermole concentration process *to a vanishing point*, making the reduction *step by step*, and noting the results " (R., p. 232; italics ours).

Although the process, when discovered, was exceedingly simple, the attainment of the conditions which brought about the discovery had required years of patient investigation, search with exceeding care, diligent seeking, persistence in effort, rejection of the unfit. As Mr. Ballantyne testifies:

> " The story of the origin of the agitation froth process constituting the invention of the patent in suit, is a story of untiring zeal and industry and scientific ingenuity on the part of Messrs. Sulman, Picard and Ballot " (R., pp. 214, 215).

Mr. Ballantyne testifies as to the uncertainties and difficulties which arose in the investigations of the inventors, referred to by them as " loose-end observations " (R., p. 215). One of these loose-end observations was the accidental small float which occasionally appeared in the Cattermole process (*idem*). One of their problems was that of " successfully treating slimes " (R., p. 216). Another " almost from the start " was " the reduction of the quantity of oil to be used in the Cattermole process " (*idem*). He says that investigations and discussions were taking place practically every day between the three inventors and himself " during the first three or four months of 1905 " and that

> " in or about the first week of February, 1905, at a conference at 62 London Wall, these gentlemen informed me that they had decided to get to the bottom of their loose-end observations, and for that purpose they had decided to investigate and quantify all the factors connected with the Cattermole granulation process. They informed me that they had drawn up a series of tests which they were proceeding to carry out, and they intended to have the results all plotted in curves, and we discussed the method of indicating the results. I particularly remember these gentlemen informing me at this time that they intended to reduce the proportion of oil to a vanishing point, indeed, I believe these very words were used " (R., p. 216).

Mr. Ballantyne also testifies as to the gradual bringing together of the factors and conditions which when assembled resulted in the carrying on of the process of the patent in suit. These factors he classifies as

(1) violent agitation, such as was obtainable in the Gabbett or cone mixer,

(2) oleic acid,

(3) heat,

(4) fine crushing without desliming,

(5) reduction of the quantity of oil,

(6) acidification of the pulp (R., p. 217).

When these factors were assembled and the quantity of oil was reduced step by step to the lowest limit, the discovery of the process in suit was inevitable. It only required, on the part of the inventors, care, watchfulness, a recognition and appreciation of the discovery when made, and diligent and persistent work in testing the new process—satisfying themselves that its operations were not accidental and were reliable—and the thing was done, the world was richer—the problem was solved of concentrating metalliferous ores by a process revolutionary of all that was known and used—the process of the patent in suit.

It will be noted that all of these factors were included in the scheme of investigation as stated in the report of March 3, 1905 (R., p. 447). The inventors had not only determined that these were the important factors, but had assembled them and directed an investigation of them and of their relation to each other. When Messrs. Sulman and Picard made this report of March 3, 1905, they had no knowledge that this investigation would carry them beyond the granulation or metal sinking process to which all their successful work had been directed, and so we find that each of the seven factors is stated to be the "influence" of that factor "on granulation." But the definite directions to reduce the quantity of oil step by step carried the investigation beyond the granulation or metal sinking process, and resulted in the sudden and unexpected and to this day not fully explained operations of the froth flotation process of the patent in suit.

As to what was done under these instructions we have

Mr. Higgins' report of March 16, 1905. The opening sentence of this report is as follows:

> "The effect of diminishing the percentage of oleic acid is to the alter the type of oiling; the higher percentages producing granules, and the lower ones froth" (R., p. 448).

This is the first mention of froth in all of the reports. The writer's mind is evidently now directed away from metal sinking and towards this new process in which the metal floats in froth. Tests with oleic acid at from 3% on the ore downward are described, with no useful result in flotation, until suddenly with the oil at .32% on the ore the result is described as "float vastly increased," and with a further reduction to .1% on the ore we find again, as compared with what has gone before, "float vastly increased" (R., p. 448). This is the oil proportion recommended in the patent in suit. Seven experiments are reported with oleic acid in this proportion, the times of agitation being varied, and the last being made the basis of an assay fully described (R., pp. 448, 449). This report clearly indicates that at this time the oil proportion of .1% was selected as "suitable and economical," as stated in the patent in suit. But the tests were carried still further, and with .2 cc. of oleic acid, or .04% (erroneously printed .4%) and .1 cc. or .02% (erroneously written in the report and printed .002%) with results which are described as "apparently not much different" and "little worse." Experiments were further carried out with no oil at all, and four of these experiments are reported with a note that in one of them the production of froth "was found to be due to some concentrates sticking inside the Gabbett cone from previous experiments" (R., p. 448). Thus the experiments were carried to the vanishing point and between that point and the minimum previous practice in the granulation process, to-wit: with oleic acid one and one-half per cent. on the ore (R., p. 445, *p. 891) was found this unexpected and startling phenomenon, the flotation of the metalliferous mineral in the form of froth. The experiments started with a metal sinking process, dependent for its utility upon the agglomeration of metallic particles into granules of sufficient size to sink readily and certainly in an up-current

which would carry away all the gangue particles. As the proportion of oil was diminished granulation became progressively poorer, and in fact disappeared. Then came the new phenomenon, with new principles of operation and a new result. This attained its maximum when the oleic acid was present in the proportion of .1% on the ore.

The method of separating the froth by stopping the agitation, allowing the sands to settle, and " then inserting a funnel so that it dipped into the clear liquid, and pouring more water in, until the whole of the froth was floated over the sides of the Gabbett " (R., p. 450) is also described, this, with the assays, showing that the process was completely carried out and its results ascertained prior to the rendition of this report on March 16, 1905.

Additionally to the reports of Mr. Higgins both before and after the discovery, dated March 2, 1905, and March 16, 1905, and the reports of Messrs. Sulman and Picard, dated March 3, 1905, describing the field of investigation to be covered by the tests of Mr. Higgins, and a later report of Messrs. Sulman and Picard, dated May 3, 1905, fully describing the process and further work thereon, there is a third series of contemporaneous documents recording the discovery. These are letters from Mr. Ballot to Mr. Courtney, then consulting engineer of the complainant Minerals Separation Ltd. in Australia (R., p. 159). With one of these letters, dated March 3, 1905, Mr. Ballot forwarded copies of the Sulman and Picard report of March 3, 1905, and Mr. Higgins' report of March 2, 1905, and commented upon them as of interest. This letter was written before the process of the patent in suit was discovered. The next letter of Mr. Ballot to Mr. Courtney is dated March 10, 1905, and from it the following is quoted:

> " I am pleased to tell you that during the week we have made some very important discoveries which will, I think, almost revolutionize our processes by way of simplifying and cheapening the same. I hope that by next mail the work will be sufficiently far advanced to send you full particulars. Several points have yet to be determined, and the discoveries are of such a nature that we have decided to take our expert and counsel's opinion thereon with a view to assuring ourselves that we can get good protection under patents. I may mention for your private information that we do not use

more than .1% of oleic acid per ton of ore and although we have not assays out that the recoveries will be very satisfactory " (R., p. 159).

This is the earliest document describing the invention. It fixes beyond question the fact that it was discovered during the week between March 3 and March 10, 1905. The letter was written six days before Mr. Higgins' written report describing the tests of the invention, but Mr. Ballot says that these discoveries "almost revolutionize our processes" and that "we do not use more than .1 per cent of oleic acid per ton of ore." This report shows Mr. Ballot's full knowledge and appreciation of the discovery that had been made, and that the patenting of the invention was even then under consideration.

One week later, on March 17, 1905, Mr. Ballot again wrote to Mr. Courtney. He enclosed a copy of Mr. Higgins' report of March 16, 1905, received that morning. He fully and accurately describes the process. He says that the experiment has been repeated again and again. He recommends testing it in Australia and suggests mechanical appliances for separating the froth. He further says that this discovery

> "reduces the consumption of oleic acid to a vanishing point, being only .1% per ton of ore treated" (R., p. 160).

He also suggests that

> " it will hardly pay to recover the oleic acid " (*idem*)

in the case of an ore not requiring separation or breaking down of the concentrate after it has been separated from the gangue. It is to be remembered that Broken Hill ore is a mixed ore of lead and zinc, with traces of silver, and at that time it was deemed necessary to separate the metals in the mixed concentrate. The inventors at that time had not performed any experiment for the separation of the metals in the mixed concentrate. Obviously this is no part of the invention in issue. When, later, it was necessary to separate the metals in the mixed concentrates it was found that the almost infinitesimal oil coating did not interfere with such operation.

This occurred at the Saxbergets plant in Sweden, as testified to by Mr. Chapman (R., p. 194). When the metal is coated with oil in Cattermole proportions the particles tend to stick together. Indeed the Cattermole process depends upon this adhesive physical condition. Obviously it is difficult to separate, one from another, particles which tend to stick together. In the process of the patent in suit this stickiness has disappeared altogether and does not interfere with the subsequent separation by physical treatment, although it may well be a factor in a subsequent chemical treatment. As above noted, the opinion of the Circuit Court of Appeals criticizes the invention and apparently declines to accept the proved fact that it is unnecessary to remove the oil from concentrates produced by the process of the patent in suit for subsequent physical treatment, because Mr. Ballot in this letter of March 17, 1905, suggested that it might be necessary to remove the oleic acid as a necessary step in rendering the concentrates fit for separation by vanning of the mixed metals in the concentrate (R., p. 721). It happens that the separation of the metals in Broken Hill concentrates is not necessary, since the smelters prefer the mixed concentrates of this ore and penalize zinc concentrates not containing a fair proportion of lead (R., Chapman, p. 394), so that the Swedish plant above referred to is the only one in which there is a subsequent physical treatment, in this instance by magnetic separation and shaking tables to separate iron, zinc and lead (R., Chapman, p. 194; p. 394).

One of the announced objects of defendant in taking testimony in London was to prove that Messrs. Sulman, Picard and Ballot were not original and joint inventors of anything set forth and claimed in the patent in suit (R., p. 127, paragraph 6). That the testimony obtained proved the affirmative of this negative proposition has perhaps sufficiently appeared. Something may be said, however, of the fact that Mr. Higgins, acting under specific written instructions and daily oral instructions and supervision of the inventors, did actually himself perform the first experiment which was a carrying on of the process in suit. Something may also be said of his testimony that when he carried on this experiment he recognized the fact that a new process had been discovered (R., p. 179, Q. 91). The fact is, how-

ever, that it makes no particular difference who performs the actual experiment which results in a discovery. The minds that plan and direct it are the inventive minds. The metallurgist who works under the plans and in accordance with the directions of the inventors is himself no more the inventor than is the mechanic who shapes and puts together the parts of a machine under the plans and direction of the inventors. Mr. Higgins was the inventors' hands to do and eyes to see. An invention, as stated by this Court, is "a mental result" and the "machine, process or product is but its material reflex and embodiment" (Smith v. Nichols, 88 U. S., 112, 118; opinion by Mr. Justice SWAYNE). The defendant has proved that Messrs. Sulman, Picard and Ballot, in joint conference, decided upon a series of procedures, as a culmination of their researches over a period of years, and that when these procedures were carried out pursuant to their instructions and under their supervision and direction, the process of the patent in suit emerged. The defendant has, therefore, supplemented the strong presumption of inventorship arising out of the patent itself, by proof that Messrs. Sulman, Picard and Ballot were in fact the original and joint inventors of the process of the patent in suit.

It may be suggested that the testimony of the four witnesses called and catechized by the defendant in August, 1912, as to their memory of events which happened from 1902 to 1905, is not completely and entirely consistent. It would be surprising if they had been in exact agreement in their recollection of events which happened from seven to ten years before their testimony. The fact that there are slight inconsistencies in this testimony is evidence of the truth and sincerity of the witnesses.

So also as to the reports, prepared merely for the records of the Company, the only remarkable fact is that they contain as much information as is contained in them. Very many subjects are only touched upon in the reports. For example, in the Higgins Report of March 2, 1905, it is stated that, during experiments directed by Mr. Sulman to determine the rate of change of granulation with temperature, the influence of other conditions was sufficiently marked to suggest their importance, and that these conditions have been carefully examined (R., p. 444), but nothing identifiable by the reports alone

further appears as to these other conditions. Mr. Higgins testifies as to these other conditions (R., p. 181), which are evidently of no importance in this controversy, although one of them, as to the relation of the size of the revolving cone to the size of the vessel in which it revolves, is referred to at the end of Mr. Higgins report of March 16, 1905 (R., p. 450).

Again, comparatively little appears as to the investigations of the Froment process and the processes of patents Nos. 793,808 and 788,247, but this merely shows how relatively unimportant these useless flotation processes were. As Mr. Higgins says of his tests of the Froment apparatus in May or June, 1904:

> "At that time a good many failures were only reported orally" (R., p. 179, Q. 99).

It is plainly apparent from the reports that up to the time of the discovery of the process in suit, the one reliable process of ore concentration of Minerals Separation, Ltd., was the Cattermole process, and that after the discovery of the process in suit the Cattermole process disappeared.

So far as the claims in issue are concerned, the carrying on of the process in the single Gabbett and the separation of the metalliferous froth by skimming it off or by overflowing it, as practised during the first few days after the discovery of the process, completed the invention. It remained to be determined, however, whether the invention thus completed was capable of use in large scale operations. Had it not been it would have been of no practical value. So the next step was a test on as large a scale as was possible in London, and for this the apparatus at hand which had been provided for tests of the Cattermole metal sinking process was availed of, with the alterations therein involving the substitution of a spitzkasten for the recovery of floating material in place of water upcasts for the recovery of sinking material, this being a continuous operation, as contrasted with the intermittent operation when the Gabbett alone was used. For commercial operations it was, of course, highly desirable to have continuous operation. This is well expressed by Mr. Picard:

> "It is desirable to perform such a process continuously. As a commercial proposition, it is, of course,

always desirable to make any metallurgical process continuous if possible, though intermittent processes may be quite commercial in their results, but this process lends itself very readily to continuity " (R., p. 152).

The laboratory apparatus for the Cattermole process had at this time been changed into a single series of Gabbetts with only one upcast at the end (Report of February 21, 1905, R., p. 444). In this apparatus it was only necessary to replace the single upcast by a spitzkasten, and the particular type of spitzkasten shown in Figure 1 of the patent in suit was here used, and the apparatus was in fact the identical apparatus diagrammatically shown in Figure 1 of the patent in suit, having in mind that the specification suggests that the single Gabbett shown represents " any number in series " (R., p. 477 ; spec., p. 2, line 53). This apparatus is well described in the testimony (R., Sulman, pp. 129, 130, Q. 22 *et seq.*), but it is also described in the Sulman and Picard report of May 3, 1905, as an apparatus then in use (R., pp. 452, 453) and is shown in the drawing which accompanied this report (R., *p. 1047). Every detail described in the specification of the patent in suit is indicated or described on this drawing, as, for example, it is said as to the tailings from spitzkastens Nos. 2 and 3, that these may be

> " mixed if necessary and treated for mineral froth recovery in a separate Gabbett and spitzkast."

This particular method of retreatment by re-agitation which is also suggested in the specification of the patent in suit and which has proved to be the most practical method, is also described in this report of May 3, 1905 (R., p. 454, method A).

This entire report, written a few weeks after the discovery, gives evidence of the careful investigations of the inventors, and a complete understanding of the characteristics of the invention. It is of peculiar interest that one of the questions which was then investigated and completely ascertained was that the formation of the froth was " due to air inclusion during the agitation " (R., p. 451) and was not due to the presence of the gases carbonic acid or sulphuretted hydrogen which might be incidentally produced or generated within the pulp by useless chemical

action. This point looms largely in the testimony of the defendant and his expert, but it was completely eliminated, within a few weeks after the discovery, by the investigations of the inventors, as appears from this report (R., pp. 451, 452).

A copy of this report was immediately sent to Australia, as appears from a memorandum on the report "Copy sent to C. F. Courtney, Geo. A. Chapman, 5/5/05"—May 5, 1905 (R., p. 450) and a similar memorandum upon the drawing (R., * p. 1047). Mr. Chapman testifies to receiving instructions and a copy of this drawing, which he particularly identifies, in or about the month of June, 1905 (R., p. 186, Q. 23). Mr. Chapman immediately set to work to alter the Cattermole plant so as to utilize this new process. He says :

> "I was very much gratified and relieved to know that we could substitute this more simple and ingenious process" (R., p. 186, Q. 23).

This marked the commencement of the commercial use of the invention.

History of the Invention—Commercial Use.

The installation in Australia of the process in suit was quickly effected in the plant then at work in the hybrid process heretofore described. The alterations made were, as Mr. Chapman testifies, "identical with the scheme suggested by the drawing" (R., p. 186, Q. 24) annexed to the report of May 3, 1905 (R., *p. 1047), and therefore identical with the continuous process disclosed in the patent in suit. The plant as thus altered was immediately put at work and the process has been at work in Australia since it was thus started, in or about June, 1905. Improvements have of course been made in details of apparatus. Other plants were erected (R., pp. 187, 188). The first plant started with the use of "2 lbs. of oleic acid per long ton of ore" (R., p. 187) which is just a little less than .1% of the ore, and as improvements were made the oil consumption was slightly diminished so that when Mr. Chapman left Australia, in May, 1908 (R., p. 190), the oil consumption was reduced to 1½ lbs. per long ton of ore (R., p. 194).

The testimony as to the various plants on the property of the Sulphide Corporation at Broken Hill, Australia, all of which " were a great success " (R., p. 188), is brought down as nearly as possible to date by the deposition of A. W. Wincey, mill superintendent of this company (R., p. 497), who left Broken Hill in the summer of 1912 and came to London and testified there. Mr. Wincey's work for the Sulphide Corporation commenced while Mr. Chapman was there and continued up to the time of his departure for London (R., p. 247). When he started at work three-quarters of a million tons of dumps, the wastage from previous concentration operations, awaited treatment. These have all been changed into valuable concentrates by the process of the patent in suit (R., p. 247). Mr. Wincey produces four photographs, taken the day before he left Broken Hill, of one of these flotation plants (R., p. 246), and these photographs are in evidence (R., *pp. 952–955). Further improvements have resulted in the use of still smaller quantities of oil, and the standard oily liquid in use when he left Australia was a mixture of "eucalyptus oil and oleic acid in the total proportion of .9 to 1.3 lbs." per long ton of ore (R., p. 247), being .04% to .058%.

As to the magnitude of these operations, it is proved that the total tonnage of material treated at Broken Hill, Australia, according to the official returns made by licensees up to June 30, 1912, was about 2,250,000 long tons, and the total tonnage of zinc-lead-silver concentrates recovered more than 800,000 long tons (R., p. 418). As to the financial returns, the value of the concentrates recovered by the principal licensee, the Sulphide Corporation, in its individual operations whereby 445,299 long tons of concentrates were produced from 1,176,934 long tons of material treated, was £1,154,353 or more than $5,250,000, and the profit was £650,153 or more than $3,000,000 dollars (R., p. 419 ; Keating, pp. 245, 246). Additionally at the plant of the Sulphide Corporation there were joint ventures of Minerals Separation, Limited, Lazard Brothers & Co. and the Sulphide Corporation wherein 636,799 long tons of material were treated and 216,181 long tons of concentrates were produced at a value of £635,371 or about $3,000,000 (R., p. 416). The profits of Minerals Separation, Limited, in these ventures was £181,688 or about $885,000

(idem.). As stated in the opinion of Judge BOURQUIN, the evidence shows that the successful operations of the process in suit

> " practically from discovery, have recovered, and largely from waste and tailings, values aggregating near $9,000,000 and at a profit of near $4,000,000 to the patent owner and its licensees " (R., p. 21).

Another important operation in Broken Hill, Australia, was that of the Zinc Corporation which has extensively used and is now extensively using the process of the patent in suit under license from the complainant, Minerals Separation, Limited. This corporation has made returns of 380,020 long tons of material treated and 132,675 long tons of concentrates obtained and additionally thereto a settlement on the basis of 12,000 tons of concentrates obtained (R., p. 418). The exact value of these concentrates was not provable, but computing them at the same value as that of the Sulphide Corporation operations covering substantially the same period, their value was about $1,800,000. The material treated was a part of the large accumulation of tailings amounting to " some ten to twelve million tons of mill residues, containing the major portion of the original zinc content " (R., p. 173). These hills or mountains of dumps were the residues of the work of the prior processes. The specific gravity of the gangue and valuable mineral was about the same (R., p. 439) and therefore treatment was hopeless by the wet gravity process which the process of the patent in suit replaced, and in fact these great dumps were the untreatable residues of that process.

Mr. Herbert C. Hoover, a managing director of the Zinc Corporation (R., p. 173) was the only mining engineer who testified as a witness for the defendant. He was clearly adverse to the plaintiffs, but nevertheless the company of which he was managing director was a licensee of the complainants, Minerals Separation, Limited, paying royalty in considerable amount for the privilege of using the process of the patent in suit which it had adopted and used after testing and discarding practically everything else that the art afforded. The details of the struggles of his company to avoid the use of the process in suit are set forth in the evidence, but will probably not be of interest to this court.

The installation of the process in suit at mines elsewhere than at Australia, so far as proved, may be briefly considered.

In 1911 the process was installed at the Finnish-American Mining Company's property at Orijarvi, Finland (R., Chapman, p. 194). It was entirely successful and doubled the recovery of the valuable metals formerly obtained with the wet gravity process which it replaced. The capacity of the plant was 50 to 75 long tons per day (R., p. 195).

Next we have the installation of the process at the Saxbergets Mine, Rafola, Sweden (R., p. 194). The capacity of this plant was from 100 to 150 long tons of ore per day (R., p. 195). The concentrates as delivered from the flotation plant were put over magnetic separators and wet shaking tables for the separation of the iron and the zinc (R., p. 194; p. 394). The oil used was a cheap locally obtained wood tar oil in the proportion of 4 lbs. per long ton of ore (R., p. 195). This is the maximum oil consumption in plants installed under the process in suit, 0.18 per cent., yet the oil was present in such minute quantity that the mixed metals in the oiled concentrates were separated by gravity treatment without removal of the oil from the concentrates.

The next mine installation was at the Braden Mines in Chile for the treatment of an ore containing 3 per cent. of copper. When the testimony was taken a plant of the capacity of 250 long tons per day had been installed and a plant for 1,200 long tons per day was in course of erection (R., p. 195). The expansion of this plant and the great work that has been done there since the testimony was closed is a matter of general knowledge.

There is some reference in the testimony to a plant in Cuba of the Cuba Copper Company which had been planned (R., p. 210) and was in course of erection (R., p. 165) when the testimony was closed.

The colossal growth in the use of the process in suit since the closing of the testimony in this suit in 1912, especially in the United States, is a matter of common knowledge, although it does not appear in the record. The process of the patent in suit has revolutionized the art of concentrating ores.

One other installation, not at a mine, but at a smelting works in Wales, remains to be considered. This was at the

Emu works near Swansea, Wales. The operations were incident to test of a zinc smelting process invented by Mr. Picard, and the object was to produce concentrates for the smelter, and this was well accomplished (R., Sulman, p. 143, x-Q. 145; Morris, p. 244). This plant produced only a total of about 120 long tons of concentrates, which were smelted and the products of the smelting furnace sold (R., pp. 243, 244). The operations are of interest by reason of the fact that the ore, from the San Francisco del Oro mine in Mexico, contained such a large percentage of calcite or limestone, from four to five per cent. (R. Liebmann, p. 312,) that the sulphuric acid there necessarily employed for its physical action in the process was wastefully consumed by the chemical action which is inevitable when calcite and sulphuric acid are brought into contact with each other. Because of this unusual condition the theoretical acid consumption in this plant was more than 100 pounds per ton of ore (R., Chapman, p. 195). This was reduced by a divided addition of the acid throughout the plurality of agitating compartments used (R., pp. 144, 145) which gave at each place of addition an opportunity for some physical action of the sulphuric acid before it was consumed chemically. The defendant puts forth the erroneous notion that this chemical reaction, which uselessly consumed sulphuric acid, was of advantage to the process because it produced the gas carbonic acid or carbon dioxide, whereas the operations afford a striking example of the wholly wasteful character of such a reaction. In the cross-examination of Mr. Chapman as to the operations of this plant (R., pp. 201–205, x-Qs. 191–223) this fact quite fully appears.

The apparatus employed in the Emu plant is shown in drawings (R., *pp. 1049, 1050) which are identified and described by Mr. Chapman (R., pp. 196, 197). These drawings also represent a large standard plant at the complainant's works in London when the defendant was employed there (R., pp. 206, 207) and it may be noted that the defendant's plants substantially reproduce this apparatus.

In the development of plants in Australia, that following the apparatus shown in the patent in suit is represented in the drawing entitled "Australian Model Plant" (R., *p. 1048; Higgins, p. 180, p. 386). The so-called King John's

Court standard plant is the latest type of apparatus used in London and is shown in drawings (R., *pp. 1051–1053 ; Howard, pp. 210, 211), and is substantially as patented in the complainant's Hoover patent No. 979,857 of December 27, 1910 (Printed R., pp. 519–522, *p. 1000).

In all of these improvements in apparatus the process remained unaltered. An agitating vessel for beating in air and a spitzkasten or separating vessel for permitting the mineral froth to rise to the surface and overflow, are the essential elements in each and every of these apparatus.

These elements are repeated in such numbers and in such manner as suits the application of the process to the ore being treated, and the ore is treated and retreated by the process in suit until the desired concentration is attained.

Infringement.

The proof of infringement is complete. The Circuit Court of Appeals says nothing on the question of infringement. In the District Court Judge BOURQUIN said:

> "In the matter of the defense of non-infringement, it appears when the charge of infringement was brought to defendant's knowledge, he refused to permit an agent of complainants to inspect his plant. This agent later secured brief access at night, observed, noted and carried away some of the froth then being produced. This agent is a mining engineer and metallurgist. He describes the defendant's plant and gives it as his opinion, being versed in complainants' process, that the process therein was substantially that of complainants. Dr. Chandler analyzed the froth so secured and found its components practically the same as those of froth from samples of some of defendant's materials thereafter furnished and treated by complainants' process, and Dr. Chandler pronounced it as his opinion, based thereon, on the testimony of the agent aforesaid, and on his knowledge of complainants' process, that defendant's operations were of complainants' process. Defendant, pending this suit, filed an application for and procured the issue of a domestic patent for a flotation process like to this in suit, which Dr. Liebmann testifies 'contains a description of the process disclosed in the patent in suit,' and 'disclosed an apparatus for

carrying on the process in suit.' And so doth it seem to the court. Although defendant testified, he professes ignorance of the amount of oil and acid used in his plant and operations. Enough appears in the evidence to compel the conclusion defendant was using complainants' process and was infringing the claims in issue as charged" (R., pp. 24, 25).

This summarizes the evidence as to infringement. The agent of complainants, who saw defendant's process in operation, was Mr. Edward H. Nutter, chief engineer of the complainant Minerals Separation American Syndicate, Ltd. His testimony is uncontradicted, and the greater part of it confirmed by defendant's foreman, Jesse C. Gibson, and by the defendant himself. The defendant admits in his answer that he has installed an apparatus and operated a process at the town of Basin, Montana, for the concentration of ores (R., p. 11, Clause IX.) and puts in evidence a sketch showing this apparatus (R., *p. 1090) and describes its operation (R., pp. 82–84). It comprises a succession of agitating compartments and spitzkasten substantially the same as in complainants' latest plants. Defendant's foreman says that in this plant for the treatment of ore pulp use was made of

"oil, acid and heat; that was all" (R., p. 74, Q. 7).

The oil used is admitted by stipulation to have been commercial oleic acid, and the acid used sulphuric acid (R., p. 74). Although defendant professes ignorance as to the quantity of the oil oleic acid and of sulphuric acid used, his foreman admits that he controlled the feed of oil and acid in accordance with a synthetic method which assured the carrying on of the process in suit. He says:

"I was instructed by Mr. Hyde as to the regulation of the supply of oil and acid, to use oil and acid in such quantity as to produce the best result" (R., p. 75).

The defendant Hyde testifies:

"In operating the experimental machine at Basin, the amounts of oil were determined at all times by an observation of the results obtained and by varying the

flow of acid and oil in such way as to give what appeared to be the best results" (R., p. 84).

His foreman Gibson further says as to the instructions under which he worked:

"Too much oil is indicated by a flat film on the surface of the water, the mineral forming globules and sinking" (R., p. 75).

In other words, when granules appeared and sank, the oil feed was in excess and was reduced. Gibson further says:

"When too little oil is used, there is no separation of the minerals and waste" (*idem*).

This, as well as the observation indicating too much oil, is exactly in accordance with the observations of those skilled in the new art which has resulted from the use of the process in suit, as testified to by Mr. Chapman, and in the testimony of Mr. Chapman he states the result of an increase, from a normal and proper feed of 1½ lbs. of oil per ton of ore to the abnormal feed of 2½ lbs. per ton of ore, as producing mineral losses by the sinking of well-oiled granulations or granules, and the result of a decrease of such normal and proper feed of 1½ lbs. of oil to ½ lb. of oil per ton of ore as producing a serious drop in recovery, a lower grade concentrate, a diminution of the froth and the presence of slime gangue with the mineral in the froth (R., pp. 195, 196, Qs. 110, 111). As to the amount of acid used Gibson testifies:

"Too much acid is indicated also by the mineral not floating" (R., p. 75).
"Too little acid makes a lower grade concentrate" (*idem*).

Thus, a certain amount of acid was necessary to obtain separation of the mineral from the gangue, and too much or too little acid made itself promptly manifest by a lowering of the grade of the concentrate carried off in the overflowing froth. As to acid quantities, however, the defendant reluctantly admits that he used approximately from ¼ to ½ lb. of

sulphuric acid per ton of ore (R., p. 94, x-Qs. 110, 111), which is well within the limit specified in the most limited claim (Claim 6), " a fraction of one per cent. " of the water present. This is very much less acid than is usually employed in those operations of the patent in suit where acid is necessary. In Australia the amount varies from 15 to 20 lbs. of acid per long ton of ore (R., Chapman, p. 194 ; Wincey, p. 247). In Finland the acid was from 16 to 20 lbs. per long ton of ore (R., Chapman, p. 195) and in Sweden and at Braden, Chile, the acid consumption was at the minimum of 5 to 6 lbs. per ton of ore (R., pp. 195, 196). The defendant suggests that his use of $\frac{1}{4}$ to $\frac{1}{2}$ lb. of sulphuric acid per ton of ore produces a slight decomposition of the metalliferous mineral, with liberation of the highly pungent and poisonous gas, sulphuretted hydrogen. Dr. Liebmann investigated this matter and found that there could be only the very faintest traces of this gas, so that it was a negligible factor, and further that it was not produced by the decomposition of the metalliferous mineral—the valuable sulphide of zinc concentrated by the process (R., p. 336). This is only relevant as to claim 11 of the patent in suit, which says that the quantity of acid shall be " insufficient to cause chemical action on the metalliferous minerals present."

As to the degree of heat of the ore pulp, the use of heat and its application by blowing steam into the first agitating compartment being admitted (R., Hyde, p. 83 ; Gibson, pp. 74, 75), Mr. Nutter made observations by holding his hand in the liquid in the first spitzkasten of the cleaner and shortly after repeating the test with a bowl of heated water and a thermometer, and determined the temperature at 102° Fahrenheit (R., p. 42). The limits specified in claim 7, which alone specifies the temperature, are " 30°-40° Centigrade," and 40° Centigrade is 104° Fahrenheit. This testimony of Mr. Nutter was given in the *prima facie* case, and was followed by no denial as to the specific temperature employed, and it must therefore be accepted as a fact that the defendant was operating within the specific heat limits of the most limited claim in issue. It may also be noted, as a matter of common experience, that the temperature Mr. Nutter determined is slightly above that of the human body, and that

the human body is very sensitive to slight variations of such a temperature.

It is therefore quite clear that the defendant used the oil oleic acid and sulphuric acid and heat within the limitations of the most limited claims in issue. That he produced the characteristic froth of the process in suit also very clearly appears. The defendant admits that in the first spitzkasten of the cleaner

> " the concentrates piled up as a tenacious froth 3 or 4 inches thick " (R., p. 84).

It was from this spitzkasten that Mr. Nutter took a sample of the concentrate froth (R., p. 42) which was carefully analyzed and found to respond to all of the conditions of a concentrate produced in accordance with the process in suit. Mr. Nutter further testifies that he saw the floating froth in all of the spitzkastens and that

> " the froth was the typical appearing agitation froth as made in plants using Minerals Separation flotation froth process " (R., p. 42).

Mr. Nutter in cross-examination first illustrates how thoroughly he has come to know the typical froth produced by the process of the patent in suit, and then describes its characteristics (R., pp. 45, 46, x-Qs. 149, 150). His testimony is met by no denial, and the previous experience of the defendant as an employee of the complainants qualified him to contradict this testimony if it were possible for him to do so.

Had the evidence of infringement stopped here, infringement would have been proved. The production of the typical froth characteristic of the process in suit is in itself an invariable indication of the use of the process. This is abundantly proved, and is proved as a conclusion from the evidence above referred to (R., Ballantyne, pp. 229, 230, Qs. 30, 31 ; Liebmann, p. 335, Qs. 46–48). Dr. Liebmann says in the testimony above quoted :

> " a froth thus produced must have been produced by the process of the patent in suit " (R., p. 335, Q. 48).

Mr. Sulman, testifying as a witness for defendant, says :

> " The phenomenon of the agitation froth production is in itself an indication of the right amount of oil to employ " (R., p. 139),

and further that an operator may be entirely governed by the result obtained in controlling the oil feed in carrying out the process in suit (R., p. 140, Q. 123).

This testimony is supplemented, however, by careful examination and exact chemical analysis by Dr. Chandler of the specimen of defendant's concentrate taken by Mr. Nutter from one of defendant's spitzkasten while the process was in operation. Dr. Chandler first removed the invisible oil coating by repeatedly washing the specimen with an oil solvent, evaporated the solvent, and identified the separated oil as oleic acid and also detected the presence of a small quantity of sulphuric acid (R., p. 55). The amount of oleic acid was found to be equivalent to 7.2 pounds per ton of concentrates (*idem*). He found by parallel tests that this was in the proportion of 3.2 pounds per ton of ore, .16 per cent. of the ore (R., p. 60). This is a little more than the one-tenth of one per cent. recommended in the patent in suit for Broken Hill ore, is lower than the highest oil proportion elsewhere found necessary in carrying on the process in suit, and is well within the limits specified in the most limited claims, claims 5, 6 and 7, as to the proportion of oleic acid to be employed.

Six parallel tests were made with stipulated specimens of defendant's ore and various oleic acids, and one of these experiments (No. 5) with a stipulated specimen of defendant's oleic acid (R., pp. 56–58). These experiments are tabulated with analyses (R., pp. 58–60). The percentage of oleic acid in experiment 5 was .35 per cent., and the average percentage for all the experiments was .37 per cent. (R., p. 59). These results as stated in the actual decimals are : Experiments 5, 0.0035 ; defendant's concentrate obtained by Mr. Nutter, 0.0036 ; average of the six experiments, 0.0037. Thus the experiments differed only by one figure in the fourth place of decimals from the percentage determined in the concentrate taken by Mr. Nutter—a remarkably close approximation.

Dr. Chandler also analyzed the concentrate obtained by Mr. Nutter and found it contained 55.47 per cent. zinc (R.,

p. 55), quite comparable with the 56.05 per cent. zinc in the concentrate of experiment 5 (R., p. 60). He also made sieve examinations and found that nearly all of it passed through a 150 mesh sieve (R., p. 56), showing that it was very finely powdered, in fact nearly all slime.

Dr. Chandler's conclusion, based upon the testimony of Mr. Nutter and upon his own experiments, is that the defendant was using the process pointed out in all of the claims of the patent in suit which are in issue herein (R., p. 61, Q. 16). This conclusion was not in any way modified by the cross-examination. Defendant's expert makes some criticisms of this conclusion in which, however, he appears to overlook the parallel tests (R., p. 119). Dr. Liebmann in rebuttal replies to this testimony as follows:

> "Relative to the criticism by Dr. Byrnes that the conclusions which Prof. Chandler drew from his very exact experiments with defendant's ore, are based upon pure speculation, I must frankly confess that I cannot follow the bent of his mind, which led him to say this. Dr. Chandler made an analysis of defendant's concentrate by a recognized method, which cannot be improved upon, and drew his conclusions from the results which he obtained. He confirmed the correctness of his conclusions by a series of well conceived experiments which could not be improved upon, and I accept his results as facts, as everyone else who knows the great reputation of Prof. Chandler both here and abroad will do" (R., p. 335).

During the progress of the suit the defendant's first plant was replaced by another apparatus substantially the same (R., Hyde, p. 95), and in it the same process was carried on. The evidence in relation to this plant need not be considered by the Court. Defendant's expert, Dr. Byrnes, however, describes this plant (R., pp. 115-117) and its operation in the production of a floating froth of concentrates (R., pp. 117, 118) and the results of feeding oil in excess that metal particles adhering together appear in the tailings, and testifies as to certain tests made by him in this plant (R., p. 118). He strangely found it operating at temperatures just below the lowest temperature 30° Centigrade stated in claim 6 of the patent in suit. He lowered the temperature and lost mineral in the tailings. He raised the temperature again and ob-

tained better results. Finally at 30° Centigrade he changed the oily liquid, and, using cottonseed oil at about three times the customary rate of feed of the red oil or oleic acid, he says he obtained good froths, and tailings quite good "although containing some mineral." Then he increased the cottonseed oil to seven times the customary feed of oleic acid and also added "a few per cent. proportionate to the cottonseed oil, of the 'red oil'" or oleic acid, and says he obtained good heavy froths and clean tailings, but in the absence of analyses or even samples of what he obtained, this may be doubted. If he did, however, he may have carried on the process first made known to the world by the patent in suit with something more than one per cent. of his peculiar mixture of oils, thereby accentuating the importance of those claims which point out the process without exact limitations of the amount of oil used, to-wit: claims 9, 10 and 11. The one thing that he did not do is significant. He did not vary the feed of the oleic acid alone, or, if he did, he does not tell us what results he obtained. Without question a slight variation in either direction would have been immediately evident in its impairment of the process.

It is significant also that when he wished to measure the rate of feed of the oil, he did so easily and accurately (R., p. 124, x-Qs. 77–79). It may be added that, as Judge BOURQUIN found, the defendant's professed ignorance of the amount of oil which he employs is unbelievable, since the consumption of materials is one of the very important items of expense of every operation and is watched very carefully in all mining and concentrating operations.

During the progress of this suit the defendant obtained a patent for alleged improvements upon the process in suit, and alleges that he was operating under this patent. Judge BOURQUIN treated this as corroborative on the question of infringement, saying:

> "Defendant, pending this suit, filed an application for and procured the issue of a domestic patent for a flotation process like to this in suit, which Dr. Liebmann testifies 'contains a description of the process disclosed in the patent in suit,' and 'disclosed an apparatus for carrying on the process in suit.' And so doth it seem to the court" (R., pp. 24, 25).

In this connection reference may again be made to *Smith v. Nichols*, 88 U. S., 112, 119, wherein Mr. Justice SWAYNE said :

> " A new idea may be ingrafted upon an old invention, be distinct from the conception which preceded it, and be an improvement. In such case it is patentable. The prior patentee cannot use it without the consent of the improver, and the latter cannot use the original invention without the consent of the former."

This Hyde patent is hereinafter considered under that heading (*infra*, pp. 205, *et seq.*). It is believed to be a worthless and void patent, but were it a valid patent for an improvement, it would still be true that its use by defendant could not in any manner relieve the defendant from infringement of the patent in suit.

Prior Practical Art.

The prior practical art has been heretofore referred to.

When the process of the patent in suit came into being, the concentration of ores was being carried on by the wet or gravity process, or *water concentration process*, with the employment of shaking tables, vanners, water upcasts and like apparatus depending upon the difference in weight or specific gravity, or more properly in sinking power in water, between the usually heavier metalliferous mineral and lighter gangue. Here the values went to the bottom.

The *Elmore oil buoyancy flotation process* had been tried on a commercial scale and had been abandoned (R., pp. 213, 214, Q. 9). Here the values went to the top.

The *Cattermole metal sinking process* had not yet been put to work on a commercial scale, but it was thus put to work at a single plant in April, 1905, after the discovery of the invention in suit, but in ignorance thereof, and worked only for a few days, and was then abandoned and the apparatus operated with a makeshift hybrid process for a few weeks until knowledge of the process in suit saved the situation and relegated the Cattermole process, its modifications and its supplements, to desuetude. In this Cattermole process the values went to the bottom.

Prior Documents.

The above is the simple history of the practical prior art. But it is the privilege of a defendant to dig up from obscurity any and all public documents whatsoever, how little instructive they may have been to the practical art, and to endeavor to point out in these documents an anticipation of the invention. A considerable array of such documents has been offered in evidence and commented upon, although comparatively few of them have been mentioned in the two decisions in this case. Other documents have been referred to (and were relied upon by the Circuit Court of Appeals as anticipative) which were not public documents when the invention was made, such as the Schwarz and Kirby patent applications and the Froment description. All of these documents, public and private, will now be considered, substantially in chronological order, under separate headings. In connection therewith attention will be called to any evidence as to practical use or attempts at practical uses of what is disclosed in these documents.

Every document referred to in the evidence will be considered. Defendant's counsel have changed their ground at each successive argument in the case, presenting in the Circuit Court of Appeals patents not mentioned or abandoned as defenses before Judge BOURQUIN. It is therefore impossible to predict the line of defense in this Court, and we are compelled to treat in this brief every document in evidence as though defendant intended to rely upon it.

Herodotus.

Mr. Ballantyne reports briefly the substance of a passage in Herodotus (Fifth Century, B. C.) describing the utilization of pitch on feathers for picking up particles of gold from sand at the bottom of a lake (R., p. 222, Q. 22). This shows early knowledge of the affinity of oil for metallic particles immersed in water, and of the agglutinating action of oil in quantities suitable to that end.

Haynes British Patent.

This patent No. 488 of 1860 (printed R., pp. 523-526) was set up in defendant's answer (R., p. 12) but was not referred to in defendant's testimony, although defendant's expert undoubtedly presented everything that he deemed of the slightest relevancy in his effort to show anticipation of the invention in suit. Because of its historical importance as the earliest patent describing the use of an oily agent in the concentration of ores, it was put in evidence by the complainants. It is classified by Dr. Chandler as the first patent under that heading and briefly described by him and summarized as disclosing

> " the making of a mixture which would be a stiff paste and then triturating in water to wash out the gangue " (R., p. 365).

Dr. Liebmann also briefly describes the process here disclosed as follows :

> " The ore is mixed with oil to form a stiff paste, which is then kneaded with water to wash out the gangue. It is not a practical process " (R., p. 334).

Mr. Ballantyne also referred to this patent as one of the documents which he had dug up from obscurity in an exhaustive investigation of ore concentration, and says :

> " This describes a process for obtaining metals from their ores, which consists in mixing the ore (ground to 100 mesh) with oily or fatty matter and bituminous or tarry matter so as to form an admixture of the agent and the ore. The admixture which is in the form of a stiff paste is then kneaded in water with the object of washing out the gangue. I have frequently tried to work this process and unquestionably some gangue can be washed out of the pasty mass, but any such process is entirely impracticable, and the process never could have been of any use, but it is an interesting scientific curiosity " (R., pp. 220, 221).

This is all of the evidence in regard to this patent. Nevertheless defendant's counsel succeeded in convincing the Circuit Court of Appeals that the Haynes patent disclosed a

froth flotation process, substantially the same as and of equal efficiency and usefulness with the process in suit. We quote from that opinion as follows:

> "Turning to the patents which are adverted to as showing the prior art, we find the following: The British patent to Haynes, No. 488, issued in 1860, recommends the use of from 11 to 25 per cent. of oil by weight to the finely powdered ore, the mixture to be agitated with water, either warm or cold, until the earthy matter sinks and the metal is gathered by the oil. In that process the sunken earthy matter is removed, fresh ore is replaced, and the operation repeated with the same oil until it will take up no more metalliferous matter" (R., p. 716).

And again

> "The Haynes' patent uses 11 per cent. of oil to the ore, and directs that the mixture be agitated with hot, warm or cold water" (R., p. 720).

Then shortly following the above quotation and with reference to Haynes and the other patents referred to in the opinion, as anticipative, and the patent in suit:

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth in all these processes is the same, with the exception that there is less oil (as there must necessarily be), in the appellees' froth than in the others. The froths are all similar in appearance, they all rise to the surface after the same amount of agitation, they all gather with equal efficiency the same quantity of metal, and all may be removed from the surface in the same way" (R., pp. 720, 721).

This Haynes patent received most careful consideration in the Privy Council judgment above referred to in determining that the Australian patent for the Elmore bulk oil and oil-buoyancy flotation process was not infringed by the froth flotation process here in suit. The Privy Council said:

> "Haynes' patent, published in 1860, describes a method of separation of metal from gangue by the use

of an agent containing fatty or oleaginous matter. This document, is, however, not more than an indication of the date at which attention was first directed to the affinity of oil for metals, and does not affect the novelty of the invention claimed" (R., p. 749).

The total misconception by the Circuit Court of Appeals of the disclosures of this Haynes patent, appears largely to have arisen from the statement at one part of the specification that the earthy matter sinks "to the bottom of the water" (R., p. 526) during an agitation in a mortar mixing machine which "gradually effects the separation of the metal from the earthy or non-metallic matters" (*idem*). In fact, however, this description accentuates the gentle nature of the agitation used and the accompanying statement "the metal being retained by the agent" (*idem*) sufficiently indicates the presence of a mass of united sticky material and metallic matter from which the earthy matter is squeezed out by the operation. The Haynes patent, to those skilled in the art, is plain and clear in its disclosures. The British Privy Council had no difficulty in understanding it. Defendant's expert cast it aside as worthless by way of anticipation. The Circuit Court of Appeals disregarded the evidence of those skilled in the art and placed its own interpretation upon language not wholly pellucid to the uninformed, and created a conception of froth flotation of the metalliferous mineral out of the statements that the mass was agitated and that the gangue sank. There is absolutely no other foundation for that misconception. The Circuit Court of Appeals also said that it relied upon demonstrations of this process made at the argument. There was no foundation in the evidence for any such demonstration, and there was in fact no such demonstration, but defendant's counsel did represent one of the laboratory manipulations performed in court as a carrying on of the Haynes process.

Again the specification says that the operation of concentration is followed by another operation to remove the sticky material from the metal. The patentee says: "I put the agent and metal still in union in a vessel containing an alkaline solution * * * and in a short time the metal is precipitated to the bottom and may be removed" (*idem*), and this again sufficiently indicates what any test of the disclosures

would clearly show, that the separation operation produces a doughy mass of the sticky material and metal, obviously not floatable, and that, when this is broken up by changing the sticky material to soap, the metal is precipitated and falls to the bottom of the water.

In an earlier part of the specification the process is described as mixing the sticky material and dry ore, then adding sufficient water " to cover the whole bulk " and then working the mass in a triturating machine to squeeze out the gangue, and it is said :

> " When the earthy or foreign matter has separated from the agent and metal, which alone remain in union, I remove such earthy or foreign matter, and replace it by fresh ore or matrix, and repeat this till I find my ' agent ' will take up no more met " (R., p. 525).

This the Circuit Court of Appeals refers to, indicating that thereby the 11 per cent. to 25 per cent. of oil recommended is reduced to lower percentages (R., p. 716, lines 10 to 3 from bottom), which, of course, is true to the extent that a sticky doughy mass can still be maintained which will retain the metal particles. Obviously you can squeeze the gangue out of a pasty mass and after you have done so you may add ore and squeeze again and separate more gangue. It is not conceivable, however, that you could squeeze a froth to get out gangue as the Circuit Court of Appeals suggests.

The fundamental error of the Circuit Court of Appeals was that it overlooked the evidence of those skilled in the art explaining this patent, and the utter failure of defendant's witnesses in *sworn* testimony to put this patent forward as an anticipation, and permitted itself to be imposed upon by the results obtained by the manipulations of skilful experimenters at the argument, and accepted the miniature and wholly unauthorized procedure of these skilful manipulators as demonstrating the Haynes process, and as evidencing its practicability.

Bradford Patent.

This patent No. 345,951 of July 20, 1886 (printed R., pp. 574–578, *p. 1092), contains the first disclosure of an effort to float mineral, in this instance without using any oil at all. Defendant's expert Dr. Byrnes says that this patent

> " utilizes the well known fact that finely divided minerals, although having a weight or specific gravity much greater than that of water, will nevertheless float on the surface of water, provided they are dry or only slightly wetted, or if wetted, are re-aerated by lifting them out of the water into the atmosphere whereby they become coated with a film of absorbed air. Such particles float on water by reason of the well known capillary phenomenon called ' surface tension,' the upper surface of the water acting like a thin, elastic membrane, and being slightly depressed by each air-coated particle, not coming in actual contact with it, but depressing the surface of water beneath it until it displaced an amount of water equal in weight to that of the particle. In this way films of dust float on water, although the dust consists of individual particles of rock much heavier than water. An illustration of this phenomenon is the fact that a sewing needle, although having a specific weight about eight times that of water, will nevertheless float on water if the surface of the needle be coated with a slight imperceptible film of oil or grease " (R., p. 97).

This is the whole of the description of this patent in defendant's evidence, and sufficiently establishes the fact that it does not anticipate the process in suit. The description is, as suggested, equally applicable to the film or skin flotation of *oiled* metallic particles which was a later development of the art.

Dr. Liebmann briefly explains this patent (R., p. 253). Its object is to save the losses from shaking tables, vanners and jigs, the well known apparatus of water concentration, and these well known apparatus are diagrammatically illustrated in the drawings. Nothing of any practical value came from this patent, and it is of interest that the patentees of the patent in suit in their researches just prior to the discovery of the process in suit, worked out a process like this of Bradford,

in ignorance of the Bradford patent, and gave it a thorough trial in the effort to obtain some useful results, but without avail (R., Ballantyne, p. 225).

Everson Patent.

This patent No. 348,157 of August 24, 1886 (printed R., pp. 579–583), to Carrie J. Everson, is the first patent of a series of three patents recording a conspicuous failure in the art. It does not disclose flotation of metals. It does, however, contain the disclosure of the use of a mineral acid in connection with an oily agent "to cut the sand away from the otherwise cohering mass" (R., p. 581).

The process, like that of Haynes, involved the production of a coherent mass of oiled metal particles, and added to the Haynes disclosure the use of acid to accentuate the separation of oiled metal from gangue.

The patent discloses two methods of treatment. The first is so clearly described as one wherein a pasty mass of oil and metal is obtained by kneading a dough of oil and ore in water, that defendant's expert passed it over without remark. Nevertheless the Circuit Court of Appeals in its opinion appears to refer principally to this disclosure of a dough process as anticipative of the process in suit (R., pp. 716, 717), and especially mentions the minimum oil proportion of 5 per cent. of the ore which characterized only this dough process.

As to this first method the patentee states that the proportions of ore and oil are such as to produce

> "a stiff mass after the materials have been incorporated" (R., p. 581).

And her example gives a proportion of about 5 per cent. of oil to ore (R., Liebmann, p. 330). The patent further says:

> "The stirring or incorporation of the ore with the liquid should of course be *thorough* for the purpose of bringing the mineral into contact with the oil and acid as completely as possible, and after such incorporation the *mass* is then in condition for the *washing out of the quartz (gangue)* by the action of water which

> will be applied to the mass in sufficient quantities for this purpose. The washing should promptly follow the mixing, and in this operation the mass be opened out or broken up and *thoroughly stirred* in the water, in order that the sand or quartz may be freed and carried away. In treating so small a bulk as above specified the mass may be squeezed repeatedly in the hand in a basin of water, the substance so manipulated being expressed between the fingers each time it is squeezed, and thus made to expose new surfaces to the water from which the sand will be detached, so as to fall to the bottom of the basin " (R., p. 581 ; italics and parenthetical insertion ours).

At the conclusion of this operation the operator would have in his hands and sticking to his fingers and would lift out of the basin the putty like mass of oil and metallic particles. For larger work mechanical means are suggested for breaking up the mass, such for example as the mortar mixing machine suggested by Haynes, and it is said that

> " the concentrated mineral will accumulate in a pasty mass or lump or lumps and will contain the metallic portion of the ore " (R., p. 581).

Obviously the sand will remain with the water in the wash basin and will sink to the bottom of the wash basin, as the patentee states, or to the bottom of the mortar mixing machine where that is used, in this Everson paste or pudding process as in the Haynes process which it resembles.

Dr. Liebmann describes this example and states that he has carried it out and that it is an impossible process (R., pp. 253, 254). Dr. Chandler briefly describes it and says that it is altogether impracticable and that he has tried it with indifferent results (R., p. 365). Mr. Ballantyne says he has frequently tested it and that it produces a paste or mud which is kneaded under water to wash out the gangue and that it

> " is so complicated that it can be set aside because no one would ever think of carrying it out in practice " (R., p. 221).

As defendant's expert describes no test whatever of this Everson first method and makes no special reference to it, it

may be deemed to be conceded in the evidence that this paste kneading process has no relevancy to the process in suit. Nevertheless the Circuit Court of Appeals, as above noted, appears particularly to have relied upon this first method as anticipative of the process in suit.

The Everson second method is characterized by the use of a larger quantity of a thinner oil, the proportion being about 18 per cent. of the ore as the minimum (R., Liebmann, p. 330). In consequence of this larger quantity of thinner oil

> " the concentrated mass is more liquid, * * * and a somewhat different means or method should be employed for removing the sand " (R., pp. 581, 582).

Obviously the separation of the sand from the metallic material will require, as in the first method, such agitation as will expose new surfaces to the water, and this agitation is described both as to the first and second methods as " thorough " agitation. The language used in describing the second method is as follows:

> " In practice, the concentrate, after thorough agitation of the mass and detachment of the sand, will in this case be preferably removed by means of a constant overflow of water from a washing-out vessel, by which overflow the concentrate will be floated off " (R., p. 582).

The words " floated off," in describing the removal of the oily and somewhat fluid mass of oil and concentrate by the currents of water, is seized upon by the defendant as a disclosure of true flotation. In fact it is not true flotation, but merely the carrying off of material in suspension by a flow of water in the same way that the sand was carried off in the wet separation of ores as then practiced. This the patentee immediately makes clear. The next sentence is as follows:

> " Devices and methods *now well known in wet separation of ores* will be suited to this part of the operation, bearing in mind that the *sand and mineral are merely transposed or their relative positions are reversed*, because the sand is heavier than the mixture of mineral, oil, and acid. A proper selection of devices for this purpose will be apparent to those skilled in the wet separation of ores " (R., p. 582; italics ours).

These devices are jigs, shaking or concussion tables or vanners such as are described in the Bradford patent which issued just a month earlier, or washing pans such as miners used in separating sand from gold, or water upcasts (upcast classifiers or upcurrent separators), such as are later described in the Cattermole patents. The language of the patentee "constant overflow of water from a washing-out vessel" rather suggests the upcast classifier, but no specific apparatus is described, the language being addressed to those "skilled in the wet separation of ores" by whom it is said a proper selection of devices "will be apparent." The operation is, however, well described in the statement that "the sand and mineral are merely transposed or their relative positions are reversed." In ordinary wet separation the sand is carried off in suspension by the water currents. It may be said to be "floated off" in just the same sense that sand and silt are carried in suspension by a moving river. The particles flow along with the water. They may be carried upward and away by properly directed currents of water, but they do not float on the surface of the water. Everson's mixture of oil and metallic particles is lighter than the sand (but it is still heavier than the water) and so the relative positions of the sand and the metallic particles "are reversed because the sand is heavier", and this mixture of oil and metallic particles is carried off by the current of water in just the same way that the sand is carried off by the currents of water in ordinary wet separation of ores.

Dr. Liebmann explains this Everson second method and describes two tests wherein he endeavored to carry it out in accordance with the description, in both of which he used upcasts of water and flowed the mixture of oil and minerals away from the sand (R., pp. 254–256; p. 330). He specifically describes the products obtained by the separation, showing that they were all heavier than water, which is the unit of specific gravity or weight, as follows:

> "The specific weight of the mixture of oil and mineral of the first example was 1.8, the specific weight of the gangue 2.5; the specific weight of the mixture of oil and mineral of the second example was 1.7, of the gangue 2.5" (R., p. 355).

It may be noted also that in Dr. Liebmann's second example he started with defendant's ore containing more than 20 per cent. of zinc, and the mixture of oil and metals separated contained only 12 per cent. of zinc (R., pp. 255, 256), so that the process was one of dilution rather than concentration. Dr. Liebmann says of this Everson second method:

> "It is from the results of my experiments an unsatisfactory process and my opinion of it is confirmed from the fact that the process has never been carried out in practice" (R., p. 254).

Dr. Chandler also tested this Everson second method and describes his test in full (R., pp. 365, 366) and says:

> "The separation was a complete failure" (R., p. 366).

The Analysis shows that he started with 21.8 per cent. of zinc in material treated and that as the result of the treatment in accordance with the Everson process he obtained in what should have been his concentrate 15.8 per cent. of zinc. and in what should have been his reject, waste or tailings, 22 per cent. of zinc, while the gangue or insoluble was greater in what should have been the concentrate than in what should have been the reject or tailings (R., p. 386).

In behalf of defendant Dr. Byrnes testified to having made a single experiment which he says carried out the operation of the Everson patent, by using the modern slide machine to effect repeated violent agitations of the ore and repeated removal of the floating material after agitation and settling. By performing this operation nine times he obtained a product which he says contained the greater amount of the zinc (R., pp. 106, 107), but in the absence of analyses this may well be doubted. His opinion, unsupported by analysis, has no evidential value.

His procedure was not the procedure disclosed in the Everson patent. He took material in the proportions of Everson's second method and operated upon them in a manner unknown in 1886. As Dr. Chandler says:

> "His test resembles the Everson procedure only in the quantities of materials used. In all other particulars he uses the knowledge of to-day" (R., p. 365).

Dr. Liebmann also severely criticised this test and says of Dr. Byrnes' procedure :

> " There is no description of such a process to be found in the patent " (R., p. 255).

The slide machine which Dr. Byrnes used in his test (illustrated R., * pp. 1054, 1055) is the peculiar laboratory apparatus which was devised by Messrs. Sulman and Picard in 1909 (R., Sulman, p. 145 ; Picard, p. 250 ; Howard, p. 207 ; Chapman, p. 191 ; Ballot, pp. 157, 158 ; Sulman and Picard Report of Feb. 24, 1910, p. 458), for small scale tests of the process in suit. Its upper part is slid off, after agitation and settling, to slice off the floating material from the surface of the liquid. It is the most highly efficient small scale agitating apparatus of the present day, particularly and peculiarly adapted for the agitation froth process.

Apparently Dr. Byrnes succeeded in obtaining a floating oily mass or magma within which a sufficient amount of air was entangled by the oil to supplement the buoyancy of the oil and cause the mass to float. This air entanglement was effected by the great violence of the agitation employed. He admits that the agitator was rotated at a speed 1,600 revolutions per minute (R., p. 122), a maximum for the process in suit and such as would only be employed with the object of maximum aeration of the pulp. Obviously no such operation can be read out of the Everson patent in the light of the knowledge of 1886. There is no mention of aeration and there is no mention of froth in the Everson specification. There is no mention of skimming the floating material from a quiescent liquid, but only of carrying off material lighter than sand by a constant overflow from a washing-out vessel or by a like operation such as is well known in the wet concentration of ores in reversal of the ordinary operation of that process wherein the sand is flowed up or off in suspension by a current of water.

Dr. Byrnes, in his consideration of the Everson specification, merely briefly summarizes what he says is the information contained in it (R., pp. 97, 98), and his own summary does not warrant the experiment in the slide machine which he says carried out the operation of the Everson process, since

he interprets the reference to wet separation by means of a constant overflow of water from a washing-out vessel as calling for the employment of a "constant current of water" which "lifts the lighter material" (R., p. 98, paragraph 6). He did not employ any such operation in his experiment and therefore did not repeat the process as he himself interpreted it. He expresses no opinion as to the practicability of the process, gives no evidence of any practical use of the process and, classifying it as an "oil-gas flotation process" (R., p. 123), which it obviously is not, testifies that he does "not know of any oil-gas flotation process for the separation of minerals ever having been commercially operated in this country other than the operations of" the defendant (R., pp. 118, 119) charged to be an infringement of the patent in suit.

Defendant's evidence fails utterly in ascribing any practical value to the Everson process, either as it is actually disclosed or as defendant's expert pretends to carry it out, whereas it is proved as a fact in behalf of complainants that the procedure followed by Dr. Byrnes and producing a floating aerated oily magma and claimed by him to represent Everson and other patentees, is a wholly useless procedure, and that in the use of the process in suit any substantial increase of the oil proportions above the minute critical proportions characterizing that process in fact destroys that process.

Dr. Chandler fairly summarizes this Everson patent as follows:

> "This Everson patent is of interest as containing the first disclosure of the use of an acid in connection with oil to prevent the oil from attaching itself to the gangue. This was an important step forward in the art, but the amount of oil used in the Everson patent was prohibitive. Apparently an attempt was made to use this process with silver and gold ores, but, even with these ores, the process appears to have been a failure, as it has only been heard of in connection with two published experiments, which I shall now consider" (R., p. 366).

These two published experiments which appear to be, although they are not proved to be, descriptions of attempts to carry out Everson's ideas, are the Fryer-Hill publication and the Criley-Everson publication and will next be considered.

As heretofore stated, this Everson patent was carefully considered by the House of Lords and is repeatedly referred to in the House of Lords' judgment (*supra*, pp. 29, 30). They did not interpret it as disclosing a flotation process. They accepted the very exact and complete disclosures of Everson's first method, wherein the concentrate was recovered in the form of a pasty lump or lumps as a complete disclosure and did not accept the rather vague and indefinite disclosures as to the second method, wherein a more liquid mass of oil and metals was recovered, as even going to the extent of disclosing the use of a freely flowing ore pulp.

Wholly in contrast with this application to this prior document of the established rule that only that which is fully and completely disclosed can be considered in its relation to a subsequent invention, the Circuit Court of Appeals interpreted the Everson first method with its 5 per cent. of oil, the production of a stiff pasty mass of oil and ore, the working of this mass by kneading when immersed in water so as to squeeze out the gangue, and the recovery of the oil and metal in a lump or lumps, as the disclosure of a process of froth flotation. They also interpreted Everson's second method wherein the recovery is said to be by a process which is the reverse of the water concentration processes then employed (wherein the sand was flowed off in suspension by a current of water which would not carry the heavier metal) and a "mere" reversal thereof, as a froth flotation process, adding to the disclosure of the specification (1) aeration, (2) true flotation, (3) metal-carrying froth. And finally the Circuit Court of Appeals accepted the court room demonstrations at the argument before them, which were alleged to represent the Everson process, as evidencing what was disclosed in the Everson patent and as evidencing a usable process of ore concentration.

Fryer Hill Publication.

This document (printed R., pp. 414, 415) was put in evidence by the complainants, after having been referred to in the cross-examination of Mr. Ballantyne (R., p. 240). Defendant's witnesses did not refer to it. It is the first of the published experiments which Dr. Chandler refers to as indicating

attempts to use the Everson process. It is an extract from a newspaper, the Daily Herald Democrat of Leadville, Colorado, dated October 30, 1889. It fails to give a definite disclosure of any process. The name Everson does not appear in the publication. There are many indications which point to the fact that the process as carried out was an oil-buoyancy flotation process such as that of Elmore. The character of the agitation is well indicated by describing the agitator as arastre-like (R., p. 415). An arastre or arrastre is a slowly rotating, dragging, grinding device illustrated and described in the Century dictionary as consisting of stones fastened to a vertically rotating shaft which is dragged around by mules, like the old sugar cane crushing machines. This sufficiently indicates a very gentle agitation such as was required in the Elmore oil-buoyancy flotation process. Apparently also the oil used was a thick petroleum, such as Elmore employed, since it is stated that this oil " appears from its density to possess the requisite adhesiveness to effect the result desired " (R., p. 414), and it is said that the " mineral charged oil " floats to the surface (R., p. 415) carrying a " precious freight " (*Idem*), evidently the particles of silver which were to be separated. The acidulation of the water with sulphuric acid is described, and in this respect the procedure resembles that of the Everson patent.

Defendant's testimony, as aforesaid, contains no reference to this document. Dr. Chandler briefly describes it (R., p. 366), as also does Dr. Liebmann (R., p. 256 ; p. 334).

Crilley-Everson Publication.

This document (printed R., pp. 415, 416) was also put in evidence by the complainants, after having been referred to in the cross-examination of Mr. Ballantyne (R., p. 240). It is an extract from the Engineering and Mining Journal of November 15, 1890. It was very carefully considered in the Privy Council case heretofore referred to and is best summarized in that judgment. It is there stated that the attention of their Lordships was directed in considerable detail to this article, the article is quoted in full, and it is said :

> " Even if the test process is not to be discarded as a failure, it does no more than give information that

if to a greased mixture of pulverized metal and rock you add boiling sulphuric acid in a sufficient quantity of water, in some way a differentiation is effected as between the metal and the gangue" (R., pp. 749, 750).

The name Everson and the use of oil and acid are the only clues connecting this article with Carrie J. Everson, whose patent has just been considered. The absence of any statement as to the amount of oil used makes it impossible to affirm or deny that there was sufficient oil for oil-buoyancy flotation. The character of the oil used, "black thick oil" (R., p. 415), indicates oil-buoyancy flotation. The statement as to the result, the flotation of "a thick scum of sulphurets" *(idem)*, also indicates the Elmore oil-buoyancy process, since the floating mass of oil and ore of that process will respond to this description. Nevertheless, in the Privy Council case it was rejected as not sufficiently definite to anticipate the Elmore process.

Dr. Liebmann describes this article and comments upon it (R., p. 256), saying that it seems an application of the process of the Everson patent with slight modifications, and also refers to it in his summary (R., pp. 329, 330), as also does Dr. Chandler, who says that the ore described is a gold ore and that the description reads like that of an Elmore bulk oil flotation experiment (R., p. 366).

Although this publication was known to Dr. Byrnes, as he admits (R., p. 125, x-Q. 88), he does not refer to it in his attempt to establish anticipation of the process in suit.

Apparently the Circuit Court of Appeals refers to this article for the purpose of adding to the Everson patent a description of true flotation. The opinion says:

"The Everson patent declares that thorough agitation of the mass or pulp, comprising water, a finely divided ore, the oil of fat and the acid, is necessary, and in the Engineering & Mining Journal of November 15, 1890, there is an article describing a test operation of that process, in which it was said that as the result thereof 'a thick scum of sulfurets' rose to the surface and was skimmed off, leaving the hitherto black ore as white as snow; in fact, pure silica" (R., p. 720).

The joining together of these two disclosures was wholly unwarranted. The patent evidently discloses something which is not true flotation but mere differentiation in sinking power, and the publication fails to disclose a process of ore concentration and merely describes a result capable of production by the Elmore oil-buoyancy flotation process. To read out of these two disclosures an anticipation of the process in suit, as the Circuit Court of Appeals did, is a violation of all the principles which control in determining the question of anticipation.

Hebron and Everson Patent.

This patent No. 471,174, of March 22, 1892 (printed R., pp. 595–604, *pp. 1120–1122) was undoubtedly issued to Carrie J. Everson as one of the inventors. It was introduced in evidence by the defendant, but is not referred to in any of the testimony included by the defendant in this appeal record. This being so, we may dismiss it as an alleged anticipation of the process in suit, but it is important historically as showing the abandonment by Carrie J. Everson of the use of oil. Instead of using oil for the purpose of separating metallic particles from gangue by making these particles lighter than sand, so that they could be separated by reason of their diminished sinking power in water, she here abandoned oil altogether and substituted sawdust to adhere to and, in this instance, to cause the flotation of the metal.

The patent is described by Dr. Liebmann (R., pp. 256, 257) and briefly referred to by him in his summary (R., pp. 328, 329). It is also briefly referred to by Dr. Chandler, who says that it is founded upon an absurd notion as to the molecular structure of metalliferous matter (R., pp. 363, 364).

Hebron Patent.

This patent, No. 474,829, of May 17, 1892 (printed R., pp. 485–493, * pp. 964–967) was put in evidence by the complainants to complete the history of the Everson failure. Carrie J. Everson is one of the assignees to whom the patent was issued. Like the patent last considered, it makes no use of oil whatsoever, and the buoyant material described is pulverized char-

coal. Dr. Liebmann briefly describes it (R., p. 257), and repeats this brief description in his summary (R., p. 334). Dr. Chandler also briefly describes it and says that it marks "a sad ending of an enterprise which started with real genius" (R., p. 364), and speaks of this and the Hebron and Everson patent as "two ridiculous patents founded upon altogether untenable theories of molecular construction" (R., p. 364).

Wagner Patent.

This patent, No. 373,113, of November 15, 1887 (printed R., pp. 584–586, * p. 1102), discloses a churn, cited by Dr. Byrnes as an example of an apparatus for agitating milk to separate out the butter fat (R., p. 119). It is wholly irrelevant, since butter-making produces a solid fatty material. Dr. Liebmann briefly describes this patent (R., p. 263), as also does Dr. Chandler (R., p. 359).

Campbell Morfit Treatise on Chemistry Applied to the Manufacture of Soap and Candles.

An extract from this book (printed R., p. 572, * p. 1088), published in 1860, was referred to by Dr. Byrnes as an example of the production of an aerated or inflated soap by twirling an agitator in a mass of melted soap. This merely shows the antiquity of the production of floating soaps and is obviously irrelevant. This publication was briefly referred to by Dr. Chandler (R., p. 359), and also by Dr. Liebmann (R., p. 263; p. 328).

Gabbett Patent.

The Boulton *et al.* and Gabbett British Patent No. 840 of 1889 (printed R., pp. 527–532, * p. 1015) and corresponding Gabbett United States patent No. 440,345 of January 6, 1891 (printed R., pp. 481–484, * p. 958), were put in evidence by the complainants. They disclose the identical agitating apparatus diagrammatically indicated in the drawings of the patent in suit. The United States patent states that the invention has also been patented in Belgium and France.

Mr. Sulman, testifying for the defendant, says that the

apparatus is known generally to metallurgists as a Gabbett or cone mixer; that it was well known in the industrial world and figured upon the covers of technical journals (R., p. 144).

Mr. Young, manager for the manufacturer of this apparatus, testifies that his concern commenced to manufacture it in 1890 and still manufactures it (R., pp. 244, 245), and that it has been extensively advertised in numerous technical and engineering journals of world-wide circulation (R., p. 244). The earlier advertisements showed detail drawings as in the patent (R., *p. 1058), but the later advertisements merely show the vessel and the revolving cone and means for revolving it (R., *pp. 1061, 1062), the detail of stationary baffles being omitted. These Gabbett or cone agitators are also shown in three Cattermole patents, No. 763,259 (R., *p. 980), No. 763,260 (R., *p. 986), and No. 777,273 (R., *p. 1190), the latter patent being specifically referred to in the patent in suit (R., p. 475; Spec., p. 1, line 17). They are also shown in the Sulman patent No. 835,143 (R., *p. 1228) and in the Sulman, Picard and Ballot patent No. 835,479 (R., *p. 1232), both of which were issued contemporaneously with the patent in suit. All of these patent illustrations and all advertisements, except the first advertisement, omit the detail of the baffles, and obviously, with such a well known appliance, such details in patent specifications and drawings are altogether unnecessary. Yet Dr. Byrnes utterly ignores the fact that this apparatus is widely known in the art, assumes that the diagrammatic drawings of the patent in suit are to be treated as working drawings, and in reconstructing what he asserts to be the apparatus shown in the patent in suit altogether omits the baffles and then criticizes the apparatus, because it does not contain the baffles.

Dr. Liebmann, interpreting the drawings of the Cattermole patent No. 777,273, properly expresses his understanding of the apparatus there shown as follows:

> "The mixers shown in the drawings are of a well known type, namely, the cone or Gabbett type. They are shown as a diagrammatic sketch. In 1904 they were well known mixing and agitating devices. I have known them as 'cone mixers' for many years before 1904. I knew them as cylindrical vessels with baffles" (R., p. 265).

Again he criticizes Dr. Byrnes for his omission of the baffles from the alleged reproduction of the apparatus of the patent in suit and particularizes as to the well known character of this apparatus (R., pp. 313, 314).

The Gabbett patents not only disclose cylindrical vessels provided with projecting ribs or baffles, but also suggest that the vessels may be made rectangular instead of circular, so that the corners will restrain the rotation of the liquid, thereby taking the place of the stationary baffles (R., p. 482). The patent is briefly explained by Dr. Chandler (R., pp. 359, 360).

Hockley Patent.

This patent, No. 466,753, of January 5, 1892 (printed R., pp. 587–591, * pp. 1106–1108), discloses an apparatus for saving float mineral, sometimes termed flour gold or silver, to wit :

> " That portion of the mineral which is too light to be saved by the ordinary gravity processes, which depend upon the greater specific gravity of the mineral, which causes the same to settle and separate from the gangue or lighter portion of the material " (R., p. 587).

This points out the slime losses of the gravity process or wet process of ore concentration, due to the fact that the metallic matter in the form of slime will not settle with the larger particles of metallic matter, but remains with the gangue and therefore is lost with the gangue. This patent gives an example of an effort to produce flotation of metallic particles separate from the gangue particles without the use of any oil. Dr. Byrnes briefly describes it, but lays no particular stress upon it (R., pp. 98, 99), and later says that it was referred to as a disclosure of the well known fact that finely divided gold and silver will float on water (R., p. 121).

Dr. Liebmann briefly describes it (R., p. 258), as also does Dr. Chandler (R., p. 363). Dr. Chandler says :

> " It is not remotely related to the invention of the patent in suit, and if of any practical value, which it does not appear to be, would never be used as an aux-

iliary even to the process of the patent in suit, because the process of the patent in suit is unique in that it concentrates and saves all slimes" (R., p. 363).

Rouse Patent.

This patent, No. 469,599, of February 23, 1892 (printed R., pp. 592–594, * pp. 1114–1116), also discloses a process for separating slimes, but does not disclose a process of concentrating slimes, that is, separating the metal slimes from the gangue slimes. No oil is used, but air is blown through the pulp and is said to

> "create or form a mass of strong foam having a great carrying energy for matter foreign to water" (R., p. 593).

Dr. Byrnes, in his very brief reference to this patent, refers to this and says that the air tends

> "to elevate all foreign matter to the surface" (R., p. 99).

This is an admission that it is not a process of concentration.

Dr. Liebmann says of this process that it

> "does not involve the use of oil or acid, and the foam mentioned in the patent is the ordinary every-day life froth which collapses, one might say, as soon as it is produced" (R., p. 258).

Dr. Chandler says:

> "No oil is used, no agitation, no acid, and the floating material is as apt to be gangue as valuable mineral" (R., p. 363).

Robson Patent.

This patent No. 575,659 of January 19, 1897 (printed R., pp. 494–499,* pp. 974, 975) was put in evidence by complainants as another example of failure in the effort to concentrate

minerals by the use of oil. Crowder is the assignee and the patent is sometimes referred to as the Robson & Crowder patent. The ore is made into a mud or paste with 25 per cent. or 35 per cent. of water, and the metallic particles washed out with enormous quantities of oil. Dr. Liebmann describes it very briefly (R., p. 334) and in conclusion says :

> " On the face of it, it is clear that this process is far too wasteful and expensive to be of any use."

Dr. Chandler also briefly considers it (R., p. 368) and in conclusion says :

> " The quantity of oil used in such a process would, of course, be enormous and prohibitory."

Mr. Ballantyne also describes it, and says in part :

> " The process is the converse of the Haynes and Everson processes. Instead of washing out the gangue from an oily mass with water, Robson and Crowder try to wash out the sulphides from a watery ore paste by the means of a stream of oil. I have tried the process. It is of no use " (R., p. 222).

Elmore Patents.

Four of these patents are in evidence. No. 653,340, of July 10, 1900 (printed R., pp. 605–607, *pp. 1130, 1131) is for an apparatus, and No. 676,679, of June 18, 1901 (printed R., pp. 608–611, *pp. 1136, 1137) is the corresponding process patent. Francis E. Elmore is the patentee. The patents disclose a process and apparatus for oil buoyancy flotation requiring about a ton of oil to a ton of ore as a minimum and employing gentle mixing apparatus to avoid aeration, whereby the oil encloses and entraps the mineral and the mixture of oil and mineral is sufficiently lighter than water to float on the surface of the water. The other two patents are to Alexander S. Elmore. No. 689,070, of December 17, 1901 (printed R., pp. 612–614, *pp. 1142) is for a process, and No. 692,643, of February 4, 1902 (printed R., pp. 615, 616, *p. 1146) is for the apparatus to be used in carrying out that process. The only

difference in process between F. E. Elmore and A. S. Elmore is that the latter adds acid to enhance the selective action of the oil, thereby applying Carrie J. Everson's discovery, and all that is patented is a variation of mixing apparatus, and in the process a procedure including mixing the ore and water with oil in the presence of an acid and separating some part of the great quantity of oil used from the concentrate after the oil has entrapped and floated off the concentrate.

Dr. Byrnes ignores the apparatus patents. He very briefly describes the process patents and says that the oiled metallic particles are

> "floated up by the oil" (R., p. 99).

In his cross-examination he excludes these patents from consideration as anticipations by saying, first,

> "The four Elmore patents offered in evidence relate to the flotation of mineral by oil *per se*, rather than gas" (R., p. 121);

And second that

> "The flotation processes described in these Elmore patents do not rely on aeration or the evolution of a gas" (*idem*).

These patents are of historic interest, for the reason that commercial plants were actually constructed and used for a time in the effort to introduce the use of these processes. The processes are characterized by the use of a very thick oil in the proportion of from 100% to 300% of the ore, that is, from 2,000 pounds of oil to 6,000 pounds of oil per short ton of ore. If a thin oil, such as oleic acid, is used, the metallic particles are not entrapped and easily fall out and sink to the bottom (Ballantyne, R., p. 213). It is also essential that the processes shall be carried out in the cold, because if the oil is heated it becomes thin (*idem*). It is essential that the mixing operation should be gentle, as vigorous agitation with the quantity of thick oil employed would change the whole pulp into a mass resembling mayonnaise dressing and this emulsion would stand without separation for months (*idem.*)

It may be further added that these processes are now of only scientific curiosity, as they have not been heard of in practice for many years (R., pp. 213, 214, Q. 9).

The disclosures of the process patents are briefly explained by Dr. Liebmann (R., pp. 258, 259). He also briefly summarizes these two patents (R., p. 330). Dr. Chandler also briefly considers these two process patents (R., p. 368), referring to Mr. Chapman's full description of tests of the processes (R., p. 197). Dr. Chandler also explains the apparatus patents (R., pp. 360, 361).

This Elmore process is the only oil-using flotation process of the prior art which went into use. As heretofore stated, it is referred to in the opinion of the Circuit Court of Appeals, not as an anticipation of the patent in suit, but for the purpose of demonstrating that the disclosures of the other prior documents could not have been processes which relied exclusively upon the buoyancy of oil to float the metal (R., p. 720).

It is undoubtedly true that later inventors, such as Kirby, Schwarz and Froment, endeavored to some extent to improve upon Elmore by diminishing the enormous amount of oil required for the Elmore process and endeavoring not to rely exclusively upon the buoyancy of oil to float the metal, and failed, probably for that reason. As to the prior patentees. Haynes and Everson, there is no disclosure of metal flotation in their patents.

This Elmore process was also considered in the two British judgments above referred to, wherein it was found that the process of the patent here in suit did not infringe the British or the Australian patents for the Elmore process.

Apparently, the Elmore processes were further improved, after the invention of the process here in suit, by the production of what is known as the Elmore vacuum process. The patent for this process is too late to be of any relevancy and was properly not put in evidence by defendant's counsel. In the cross-examination of Mr. Nutter, however, the particulars of this Elmore vacuum process were brought out by the defendant (R., p. 46; p. 47). It is also proved by the defendant that the Elmore vacuum process was abandoned by the Zinc Corporation, licensee of the complainant Minerals Separation, Limited, after a very thorough trial, and the process of the patent in suit installed in its place (R., Hoover, pp.

171, 172). It is also in evidence that at the Saxbergets mine in Sweden the Elmore vacuum process was tried and discarded and return made to the old method of water concentration, and thereafter the process of the patent here in suit was adopted (R., Chapman, p. 194).

Stoveken Patent.

This patent, No. 729,805, of June 2, 1903 (printed R., pp. 617–625, *pp. 1150-1154) was referred to by Dr. Byrnes because it showed an agitator for agitating an ore pulp (R., p. 113). This agitator (R., *p. 1151) is a circular vessel having revolving stirrer arms and stationary wings or baffles. Dr. Byrnes comments upon these baffles as an important feature to produce aeration, and says that the agitator of the patent in suit is defective by reason of the absence of baffles (R., p. 113). This merely indicates ignorance of the construction of the Gabbett or cone mixer, generally known to metallurgists, and a matter of wide patenting and publicity. It also shows, however, that there was another mixing apparatus than the Gabbett of circular form and employing stationary baffles, which a person skilled in the art could have made use of in carrying out the process of the patent in suit.

The process mentioned in the Stoveken patent, as stated by Dr. Byrnes, is the cyanide process, used for extracting gold by dissolving it chemically. Aeration is desirable, but merely to stimulate the chemical action. The disclosure is explained by Dr. Liebmann (R., p. 328; pp. 263, 264), as well as by Dr. Chandler (R., pp. 361, 362).

Delprat Patents.

These patents, No. 735,071, of August 4, 1903 (printed R., pp. 626–628, *p. 1162) and No. 768,035, of August 23, 1904 (printed R., pp. 636–638, *p. 1176) disclose processes which do not employ any oil whatsoever and in which, in the first patent, nitric acid, and, in the second patent, sulphuric acid, are utilized, not for their physical action, but for their chemical action in decomposing part of the ore and added materials, thus chemically generating a gas which to some extent

attaches itself to and floats the mineral. Comparatively strong acid solutions are required, and a considerable amount of heat is necessary to stimulate the chemical action.

Dr. Byrnes briefly refers to the first patent, without comment (R., p. 99) and ignores the second. He, however, makes a test-tube test of the Delprat method (R., p. 104, Expt. 4) and demonstrates the transitory character of the float produced by this method. He says:

> "This mineral, however, floated for a brief period only and then again subsided to the bottom of the tube" *(idem)*.

Dr. Liebmann explains both patents (R., p. 259) and again briefly summarizes them (R., p. 329); and Dr. Chandler briefly summarizes them along with the Potter patent, to be next considered (R., p. 364).

There are some indefinite statements in evidence, indicating that the owners of these Delprat patents were using or attempting to use something in practice in Australia, but there is no definite evidence as to any practical utilization of these processes.

Potter Patent.

This patent No. 766,145, of November 29, 1904 (printed R., pp. 643, 646, *p. 1186), was issued on an application filed a year earlier than the applications for the two Delprat patents, and is for a process broadly substantially the same as the Delprat processes; that is to say, it is a process not using oil and in which the metal is floated by a chemically generated gas. This is conceded by Dr. Byrnes, but he erroneously attempts to read aeration out of the disclosures of this Potter patent. He bases his conclusion, not upon the tests of the process, but solely upon the statement of the Potter specification that the revolving stirrers are "freely used." Had he made a test with the apparatus shown and described in the Potter patent, he would have found that any such speed of rotation as would have produced aeration of the pulp would have formed a maelstrom in the agitation vessel. According to the Potter procedure,

the pasty float is allowed to flow off at the top of the vessel "automatically and continuously" or is "skimmed off" (R., p. 644) during the agitation. Obviously the pasty float could not collect upon and overflow from anything except a substantially quiescent liquid surface. Anything approaching violent agitation would sink it at once. The stirrers must, therefore, be very gently operated; otherwise, the process would be altogether unworkable.

Indeed, Dr. Byrnes demonstrated the evanescent character of the Potter float in the test-tube test above referred to, which he says illustrates both the Potter and the Delprat methods (R., p. 104, Expt. 4). Here he used sulphuric acid and heat and considerable mineral rose to the surface

> "floated by the adherent gas bubbles, as in the well known Potter and Delprat methods, heretofore referred to by me. This mineral, however, floated for a brief period only and then again subsided to the bottom of the tube" *(idem.)*.

Dr. Liebmann testifies that if brisk agitation were used such as Dr. Byrnes attempts to read into Potter's specification, the result would be *nil* (R., p. 260). He also explains the patent and describes his own tests, in which he found that the gas bubbles were continually bursting and dropping the mineral to which the bubbles had been attached (R., pp. 259, 260). He also briefly summarize this patent as follows:

> "Potter is like Delprat, a flotation of minerals by gas bubbles generated in the mixture, no oil being used" (R., p. 329).

Dr. Chandler considers the Delprat and Potter patents together and in conclusion says:

> "No oil is used and there is no aeration by agitation" (R., p. 364).

The only positive evidence of an attempt to use what was probably this process in practice appears in the deposition of defendant's witness, Herbert C. Hoover, who says that it was installed by the Zinc Corporation and proved a commercial failure (R., p. 171).

Dr. Chandler's general remarks on processes not using oil (R., p. 364) may be here referred to. The period from Bradford of 1886 to Potter of 1904 produced first the Bradford, then the Hockley, then the Rouse, then the Hebron & Everson, then the Hebron, and then the two Delprat patents and the Potter patent. These eight patents describe different processes wherein an attempt was made to separate metallic particles from gangue without the use of oil. As Dr. Chandler says:

> "They may all be taken as efforts to save the expense of oil. Two of them were further developments of Everson, but with the abandonment of oil. Not one of them discloses the process of the patent in suit, and they do not lead to or suggest the process of the patent in suit. They are evidence of the desirability of the object which was attained by the process of the patent in suit, and they show that many other inventors worked with the same object, but utterly failed and missed the invention" (R., p. 364).

Glogner Patent.

This patent No. 736,381 of August 18, 1903 (Printed R., pp. 629–631, *p. 1166), is for a process of purifying graphite. Petroleum is used in the proportion of 50 per cent. of the amount of graphite present—

> "about half as much as the amount of pure graphite contained in the graphite mixture" (R., p. 629).

Dr. Byrnes briefly refers to this patent and then theorizes upon results obtainable by using or testing the process, although he does not base his theory upon any test or knowledge of use of the process (R., p. 99). His theories are ridiculous. According to the patent the mixture is held in a swinging pot and shaken by hand with "short shocks, about thirty per minute" (R., p. 630). This is at the rate of one shake every two seconds. Dr. Byrnes says this will aerate the pulp and cause the oiled mineral to float to the top as a froth

> "just as an ocean wave entangles air and forms a floating froth or foam" (R., p. 99).

Again he says :

> " Glogner, 736,381, illustrates an oscillating agitating vessel, in which the mixture of ore-pulp and water is thrown violently against one end of the vessel, the waves falling back through the air, thus imitating the aeration and frothing produced by an ocean wave " (R., p. 110).

This is nonsense, as a simple test would have shown him. Dr. Liebmann made such a test and the result was as follows:

> " The top of the liquid was then a smooth surface of petroleum carrying graphite. Underneath were some little globules of oil carrying graphite. There was no froth whatever " (R., p. 262).

Dr. Chandler also tried it out in practice with the same result :

> " Not a particle of froth or foam was formed. The graphite floated to the surface entrapped in an oil layer, which was remarkably smooth " (R., p. 369).

Dr. Chandler says that this patent " describes a bulk oil flotation process " (R., p. 368), which it undoubtedly is, applied to the mineral graphite, which does not require as large a proportion of oil as the metals. It is to be noted also that the specification directs as many repetitions of the operation as may be necessary, with an addition of more petroleum before each repetition of the operation, so that a considerable amount of petroleum might well be necessary to complete the separation of the graphite from the other material with which it is mixed. Dr. Liebmann's full consideration of this patent may be here referred to (R., pp. 260–262).

Mr. Ballantyne includes this patent and the other graphite patents Good and Kendall in his description of those processes which have not to any extent been utilized in the arts (R., p. 220, Q. 22) and further says :

> " These processes depend upon the same phenomenon as the Elmore process but in so far as graphite is very easily floated by oil, a smaller quantity of

oil can be used with graphite than with metallic sulphides. * * * the expense of all bulk oil methods would prohibit their use in the treatment of graphite ores, where the margin of profit is, of course, much lower than with valuable minerals like zinc, lead and copper" (R., pp. 224, 225).

Good Patent.

This patent No. 745,960 of December 1, 1903 (printed R., pp. 632–635, * pp. 1170, 1171), discloses a graphite separating apparatus. Dr. Byrnes refers to it briefly without comment (R., p. 99). Except by including it in his classification of oil-gas flotation processes (R., p. 123) he does not again refer to it.

Dr. Liebmann carefully analyzes this patent (R., pp. 262, 263). The apparatus is divided into three parts, the first producing a separation of graphite flakes by skin flotation, the second doing the same by oil-buoyancy flotation, and the last grinding the graphite flakes so as to form an oily pasty mass. No aeration or gas generation is disclosed, and in fact no process is fully described, the patent being for the apparatus.

Dr. Liebmann again more briefly summarizes this patent (R., p. 331) and Dr. Chandler approves of Dr. Liebmann's description and says

> "the patent discloses nothing having any relation whatever to the process of the patent in suit" (R., p. 369).

Kendall Patent.

This patent No. 771,075 of September 27, 1904 (printed R., pp. 639–642, * p. 1181) was put in evidence for the defendant, but is ignored by Dr. Byrnes. It is the last of the graphite series and clearly discloses an oil-buoyancy process in which oil

> "adheres to and by reason of its levity separates the graphitic substance (this may be more or less pure graphite) from associated rocky matter, which by reason of its weight and non-affinity to oil sinks in and is conveniently carried off by the water" (R., p. 639).

Dr. Leibmann briefly refers to this patent (R., p. 264; p. 331), as also does Dr. Chandler (R., p. 369). In conclusion as to the three graphite patents just considered and referring first to the Kendall patent, he says:

> "This is clearly a bulk oil process in which the mixture of oil and graphite must be light enough to float on the surface of the water. This is true of the three graphite processes which I have considered and they are no nearer to the process of the patent in suit than is the Elmore bulk oil buoyancy process" (R., p. 369).

Cattermole Patents.

There are three of these patents. No. 777,273 of December 13, 1904 (printed R., pp. 647–652, * p. 1190) is referred to in the specification of the patent in suit, and was put in evidence by the defendant. The two other Cattermole patents were put in evidence by the complainants to complete the series. These are No. 763,259 of June 21, 1904 (printed R., pp. 500–504, * p. 980) and No. 763,260 of the same date (printed R., pp. 505–510, * p. 986). The latest of these patents, No. 777,273, contains a full disclosure of the Cattermole metal sinking process which was so thoroughly and carefully investigated and tested by Messrs. Sulman, Picard and Ballot and which, as improved by them, was installed at Broken Hill, Australia (*supra*, pp. 64, 65). As heretofore stated, when, at the culmination of all this work, extending over a period of two and a half years, this Cattermole metal sinking process was installed, it was operated for a few days. The oil consumption alarmed the mine owners and it had to be modified so that it was in fact spoiled, and the actual process used was the table flotation process of Sulman, Picard and Ballot patent No. 879,985. Yet this Cattermole process was far in advance of anything known in its day. It could treat slimes, which were not treatable by any other known process. The oil proportion recommended in the patent as usually satisfactory is from 4 to 6 per cent. of the weight of the metalliferous mineral matter present in the ore, with the qualification that the oil proportion is to be determined by numerous controlling factors in each use of the process; and the lowest oil propor-

tion ever used in tests or practical operations was 1¼ per cent. of the ore.

The principal characteristic of the Cattermole process is its utilization of the principles of the old and generally used process of water concentration, with accentuation of the sinking power of the metallic particles so as to permit the gangue particles to be quite completely carried upward and flowed off in suspension by a current of water which, without the Cattermole improvement, would carry with it the finer particles of the metal. The Cattermole process agglomerates the metallic particles together, regardless of size, into granules of sufficient size and consequent sinking power in water to produce a sharp separation in the water concentration process with its reliance upon the difference in the sinking power of the metal and the gangue. The Elmore process, which was its only competitor in the effort to supplant the universally used water concentration process, operated in opposition to gravity, floating the normally heavier metallic particles. The Cattermole process utilized and accentuated the action of gravity on materials in suspension in water, or the sinking power in water. The Cattermole process was a very great improvement on its predecessor, Elmore, and in fact revolutionary of the procedure thereof. The process of the patent in suit is again revolutionary of the procedure of the Cattermole process, since here a return is made to the flotation of the heavier metals and the sinking of the lighter gangue. That it represents a colossal practical advance beyond Cattermole is best proved by the fact that it immediately wholly supplanted the Cattermole process, which really in practice died still-born, because the giant had already appeared.

Cattermole patent No. 777,273. The Cattermole specifications are full, clear and exact. No. 777,273 describes the entire process, and portions of it have been heretofore quoted to show how clearly it discloses a metal sinking procedure and nothing else (*supra*, pp. 21, 22). The exact description (R., pp. 648, 649) of what is shown in the drawing (R., *p. 1190) may be abbreviated as follows:

The first agitation occurs in a series of four Gabbetts or "mixing vessels" A^1, A^2, A^3, A^4, into the first of which is fed acidulated circuit water from the "tank D" and crushed ore from the "hopper C," and oil or oil emulsion from the

"tank E" through the cock E^1, provision being also made for oil addition in the second and third Gabbetts through cocks E^2, E^3, and for an acid addition from the "tank F" to the third and fourth Gabbetts through the cocks F^3, F^4. The agitated pulp is discharged into the water upcast or "up-current classifier G," receiving at its bottom an up-current or "stream of acidulated water" through the pipe H^1. Everything that flows upward with the up-current of water (the light sands, including slime gangue) escapes through the pipe G^2 into the "light sands tank J." Everything that sinks in this first upcast passes out at the bottom of the upcast and flows through the pipe G^1 to the first one of a second series of two Gabbetts or "mixing vessels" A^5, A^6. Acid may be added in each of these Gabbetts through the cocks F^5, F^6. The agitated pulp flows from the last of these two Gabbetts into the second water upcast or "second classifier K," which is supplied with an up-current of acidulated water from the same pipe H^1 that supplies the upward "stream of acidulated water" to the first upcast. Everything that flows upward in this second upcast, to wit, the heavy sands, is discharged through the pipe K^2 into the "heavy-sands tank M." Everything that sinks in this upcast, to wit, the "granules" of metallic particles stuck together by oil, flows away at the bottom by the pipe K^1 into the "metalliferous mineral tank L." This is the final concentrated product which has reached its ultimate situation by twice sinking against up-currents of water, in the first instance an up-current such as carried upward the lighter sand, including gangue slimes, and in the second instance by a current such as carried upward the heavier sands.

At the conclusion of this description it is said

> "the classifiers used may be jigs, shaking tables or the like" (R., p. 649),

these being, with water upcasts, the ordinary apparatus of the old water or wet concentration process, all dependent upon difference in sinking power in water for the separation of the metallic particles from the gangue particles. Mention is also made of

> " sizing apparatus, whereby the comparatively larger mineral granules may be separated from the finer gangue " (*idem*),

such apparatus being a succession of fine screens and their utility being dependent upon the production of compact granules of metallic particles all of them larger than the largest ungranulated or gangue particles.

As to the proportions of oil to be employed, it is said that this will depend upon the " viscosity " of the oil, the " fineness of the ore," the " consistency " of the mineral granules desired, the " size " of the mineral granules desired, and other factors (R., p. 649). The recommended proportion is stated in relation " to the weight of metalliferous mineral " in the material to be treated, and it is said that with " say ten per cent. of oil * * * a few pasty masses of oil-agglomerated metalliferous mineral matter will generally result " and that " oil in excess of this may cause all the granules to coalesce into one soft mass," and that

> " usually an amount of oil varying from four per cent. to six per cent. of the weight of metalliferous mineral matter present in the ore yields granules of suitable size, consistency, and specific gravity for ready separation from the gangue in the up-current or other apparatus used for classification " (R., p. 649).

As Dr. Liebmann says in explaining this part of the specification :

> " It is clear from this description that a definite amount of oil to produce good granulation effects cannot be given, as the final result is determined by many factors which have to be first experimentally ascertained. No definite law of proportions can be laid down for this process, which is a process for the treatment of a large class of substances, each differing from the other in many ways, and is in that respect like all other processes which are destined for the use of differently constituted compounds and not for the use of one individual substance. But the patentee has described his invention so well and exhaustively that a few experiments will suffice to determine the proper proportions suitable for a given ore " (R., p. 266).

The Cattermole process is a process for the treatment of rich ores or ores artificially enriched, or to which has been added matter having an affinity for oil. This appears very clearly from the specification :

> " In certain cases, as where but little mineral is present in the ore, to increase the nucleating or granulating factor pulverized mineral matter obtained in a previous operation or other matter having an affinity for oil from a different source may be introduced into the ore, or a portion of already granulated and separated mineral matter may be returned to maintain the necessary amount of mineral in the ore under treatment " (R , p. 651).

The mineral matter here referred to is metalliferous mineral matter or metallic particles. If but a small proportion of metallic particles is present, this proportion must be increased or other materials having an affinity for oil must be added, the result in each case to be decided by test, that result being the production of agglomerated granules of metallic matter which will sink in the classifying apparatus.

The minimum proportion of oil used, either in tests or commercial operations, is 1.5 per cent. of the ore, this lowest proportion having been reached in the final tests of the Cattermole process just preceding the discovery of the process in suit (R., p. 445 ; Chandler, p. 382). This, with Broken Hill ore of a minimum of 50 per cent. metalliferous mineral content (R., Chandler, p. 370), would be 3 per cent. of the metalliferous mineral present in the ore, and, with Broken Hill tailings of about 30 per cent. mineral content (*idem*), would be 5 per cent. of the metalliferous mineral present in these tailings.

There is no evidence of the carrying on of the Cattermole process by any of defendant's witnesses or of any tests of the Cattermole process by any of defendant's witnesses. Nevertheless, Dr. Byrnes expressed the opinion that because Cattermole gives his recommended oil proportions in relation to the amount of metalliferous mineral or metallic matter in the ore, and inasmuch as the theoretical application of these oil proportions to a lean ore would produce a very low proportion of the oil to the ore, that Cattermole has disclosed oil proportions overlapping those of the patent in suit, and

therefore the process in suit does not involve novel great reduction in the proportion of oil over what is disclosed in the Cattermole patent; and it may be added the Circuit Court of Appeals followed him in this absurd theoretical deduction in contradiction of facts clearly disclosed, saying:

> "The amount of oil specified in the Cattermole process is from four to six per cent. of the weight of metalliferous mineral matter present in the ore. This quantity with the average ores would be less than one per cent. of the mass treated. * * * Here is described a process in which a quantity of oil used approximates the quantity which is called for by the appellees' patent, a fraction of one per cent." (R., p. 718).

As an example of the application of this reasoning, Dr. Byrnes concluded his statement by saying that the process of the Cattermole patent, at least as applied to the defendant's ore, would be a process of flotation, *i. e.*, the oil proportion would be so reduced that the result would necessarily be flotation (R., p. 123). This ore is known as Black Rock ore, and Dr. Byrnes says:

> "I should say that the process of this Cattermole patent itself, at least as applies to the 'Black Rock' ore and with the kinds of oil used by me is one of oil-gas flotation" (*idem*).

This was tested by Dr. Liebmann and he found that with defendant's ore in two instances six per cent. on the zinc sulphide (metalliferous mineral) content of the ore and 1.8 per cent on the ore (30% metalliferous mineral content) and in another instance seven per cent. on the zinc sulphide content of the ore, or 2.1 per cent. on the metalliferous mineral content, were the correct proportions for carrying on the Cattermole process with that ore and with oleic acid as the oil (R., p. 307), and the granules which he produced in these operations, submitted to prolonged agitation with the hope that they would remain granules until the final disposition of this case, are in evidence as Cattermole Granules 1, 2 and 3 (R., pp. 307, 308).

Thus we find that the guess of Dr. Byrnes that the literal application of a portion of the Cattermole description to de-

fendant's ore would produce flotation, was wholly wrong. Obviously, however, the disclosure of Cattermole is of a process—a metal-sinking process—and the employment of that process in the treatment of any ore, with any oil, is a matter to be determined by actual trial. There is no evidence of the use of the Cattermole process, even in the laboratory, with less than 1½ per cent. of oil, and that was the absolute minimum determined upon by two and a half years of study and test of the process. There is no evidence that the literal application of the fragment of the Cattermole specification suggesting definite oil proportions, to an average ore, or even a lean ore, would bring about the use of oil in the proportion of a fraction of one per cent. of the ore. In the one instance where it was suggested that it would, the ore had a 20 per cent. zinc content, and a 30 per cent. metalliferous mineral (zinc sulphide) content, and here the literal application of this part of the Cattermole description produced from 1.2 per cent. to 1.8 per cent. of oil to ore, and the actual application of the Cattermole process required from 1.8 per cent. to 2.1 per cent. of oil to ore. The metalliferous mineral content is always much greater than the metal content of an ore, but is only proved in the record as of a minimum of 30 per cent. *Dehors* the record it is somewhat lower in lean ores. But it is against an attempt to use the process with ores approaching leanness, except by enriching the ores, or otherwise increasing the oil factor, that the Cattermole patent gives the warning above quoted which was entirely overlooked by the Circuit Court of Appeals.

The description of the Cattermole patent plainly says : I merely suggest these proportions. Try the process in practice. You must have an agglutinating factor that will cause the metallic particles to stick together and roll up into granules and sink in an upcast. If there is not enough metalliferous mineral in the ore, increase it, enrich the ore, as by adding metallic granules, or add something which will become stickily coated with oil, thereby increasing the amount of oil used and of the material to be stuck together, so as to enable you to carry on my process. My process depends upon sticking the particles together with oil and sinking them. If you fail to do this, you are not using my process.

The Circuit Court of Appeals not only so erroneously

applied pure mathematics to its interpretation of the Cattermole specification as to reach a *reductio ad absurdum*, but also as completely misinterpreted the description of the operations of that process, saying :

> " The fact that the final purpose of the Cattermole process is to increase the sinking tendency of the metalliferous mineral instead of removing it upon the surface, does not render that process any less instructive as to the state of the prior art, for there are two distinct steps in the treatment of the ore—there is first a violent agitation to cause the oil to gather up the metalliferous particles, as in the case of other oil flotation processes. Then follows a slow, smooth stirring of the mass, which releases the air from the froth or scum and causes the oil and metalliferous particles to adhere together and form granules of sufficient size and weight to sink, after which the mass at the bottom is drawn off, and the particles of sand and gangue therein are forced upward and thus separated from the granules of metal " (R., p. 718).

And again

> " And so in the Cattermole process, although its ultimate purpose was to precipitate the metal in the form of granules to the bottom of the tank, it was first required that the mixture be thoroughly agitated, and as the result thereof, a froth necessarily came to the surface " (R., p. 720).

It is clear that the process thus described is not the Cattermole process. The violent agitation such as is required for the formation of the granules in the Cattermole process undoubtedly introduces air into the pulp, and the heavily oiled particles undoubtedly reject this air, do not attach themselves to it, and permit it to escape from the pulp, for all floating material in the Cattermole process must pass upward in the upcast with the sand and slime that flow upward in suspension, and the flotation of metallic particles in the Cattermole process would give at the conclusion thereof the sand, the slime and the metallic particles, all mixed together in the sumps or tanks which normally receive the waste material. There would be no separation or concentration whatsoever.

The error of the Circuit Court of Appeals in this respect

may have been contributed to by reason of the fact that in the secret and experimental carrying on of tests of the Cattermole process in the laboratories of the complainants there was developed a separation of the agitation into two stages, the first stage, in the first series of Gabbetts, being comparatively violent, and the second stage, in the second series of Gabbetts, being comparatively gentle, and that this was followed in the commercial plant at Australia. But the Court overlooked the fact that between these two stages of agitation there was an upcast separation, and that had the first and violent agitation produced a froth, the froth or anything that floated would have been carried away with the gangue by the up-current in the upcast, and there would have been no metallic matter at the bottom for treatment in the second stage, and no useful separation of metal from gangue anywhere. This error may also have been contributed to by reason of the suggestion in the patent that

> " With certain ores it may be preferable to use in some stages of the process a rolling form of agitation, as in cylinders or barrels, to obtain good granulation of the mineral " (R., p. 651).

This suggestion might be carried out, as stated by Dr. Liebmann, by using horizontal rotating cylinders in place of the last two cone mixers or Gabbetts (R., p. 265), and it was this suggestion, probably, that originated the two stage agitation used in carrying out the Cattermole process. Obviously, however, there is not the faintest suggestion in this Cattermole patent of producing a froth and then destroying it. Nor is there such a suggestion in any of the Cattermole patents or in any of the reports or testimony as to the elaborate secret investigations that were made by Messrs. Sulman, Picard and Ballot in their study of, and efforts to best utilize, the Cattermole process.

Dr. Liebmann quite fully explains this Cattermole patent (R., pp. 264–266) and his test verifying the disclosures thereof (R., pp. 266, 267), and his application of this process to defendant's ore as above noted (R., pp. 307, 308), and states his absolute disagreement with Dr. Byrnes' argument wherein Dr. Byrnes tries to show that the Cattermole disclosure is an oil-gas flotation process (R., p. 327), and summarizes this patent

(R., pp. 331, 332), and Dr. Chandler also summarizes this patent and says:

> "No amount of juggling with figures can make this a flotation process" (R., p. 370).

and as to Dr. Byrnes' conclusion that the process is one of flotation Dr. Chandler says:

> "it seems incomprehensible that it could have been reached even as a result of pure mathematics dissociated from actual tests" (*idem*).

He also here states that he has tested the process and obtained results such as the patent describes.

Cattermole patent No. 763,260 is for that variation of the Cattermole process, to some extent described in patent No. 777,273, wherein the oil is introduced in the form of an emulsion of soap and oil. It is briefly summarized by Dr. Liebmann (R., p. 334), attention being called to the further facts that the solution used is alkaline instead of acid and that it was granted on a division of the application for Cattermole patent No. 777,273, this fact appearing on the face of the patent (R., p. 505). It is also briefly summarized by Dr. Chandler (R., p. 369). It may be noted that this patent contains the same caution against its use with lean ores (R., pp. 508, 509) as is quoted above from patent No. 777,273.

Cattermole patent No. 763,259. This patent discloses a procedure supplemental to the Cattermole process for breaking up the granules when they contain mixed metals and obtaining these metals separately, as explained by Dr. Liebmann (R., pp. 334, 335) and Dr. Chandler (R., p. 369). Defendant's witnesses do not refer to this patent, nor do they refer to Cattermole patent No. 763,260. It also specifically refers to "Broken Hill ore" (R., p. 502) as an example of ore treatable by the process.

Cattermole, Sulman and Picard Patents.

These patents, known as the Soap patents, No. 777,274 of December 13, 1904 (printed R., pp. 653-655) and No. 788,247 of April 25, 1905 (printed R., pp. 656–658), are closely con-

nected. In England there was but one patent No. 17,109 of 1903, as testified to by Mr. Ballantyne (R., p. 224), which had to be divided into two different patents in the United States by reason of the strict requirement peculiar to the United States Patent Office that two different species of a generic invention cannot be claimed in the same patent, and, therefore, if a second species is to be claimed a second patent is necessary. Patent No. 788,247 contains the broad claim for any process of ore concentration utilizing the soap reaction, and specific claims for a flotation process embodying that reaction. Patent No. 777,274 contains specific claims for a granulation or metal sinking process embodying that reaction.

Patent No. 777,274 is referred to in the patent in suit (R., p. 475, specification, p. 1, lines 23–27), as describing a method of separation similar to that of Cattermole patent No. 777,273 (also referred to), in which the oleic acid is produced *in situ* in the ore-pulp, and this brief description epitomizes patent No. 777,274, which is known as the Soap and Granulation patent.

The production of oleic acid *in situ* is accomplished by dissolving oleic soap in mineral pulp and then adding sulphuric acid, which decomposes the soap and liberates the fatty acid or oil (oleic acid) throughout the pulp. Oleic soap dissolves very readily in water and may be disseminated through an ore pulp without agitation, and there is no mention of agitation in either of the soap patents for the purpose of disseminating the soap through the pulp, and in the second patent No. 788,247 (soap and flotation) there is no mention whatever of agitation. After the soap has been thus disseminated, the production of oleic acid *in situ* takes place throughout the pulp, minute insoluble globules of oleic acid appearing therein.

In the soap and granulation patent No. 777,274 there is mention of agitation subsequent to the coating of the metallic particles, for the purpose of forming granules, and reference to the type of apparatus shown in Cattermole patent No. 763,260 as a suitable apparatus to be used (R., p. 654), it being noted that the drawings of this latter patent correspond to those of Cattermole patent No. 777,273 (R., *pp. 1190, 986).

After separation of the metal by the sinking of the metallic granules in the upcasts, the original chemical action may be reversed and an alkali added to change the oil oleic acid back to a

soap, which readily dissolves in the water present and may be washed off, leaving the metallic particles clean, and thus all the soap may be recovered and used over again, the only consumption being of sulphuric acid to decompose the soap and of alkali to recompose it. This process is scientifically and theoretically very perfect, but has not yet proven of value in commercial use.

In the soap and flotation patent No. 788,247 there is no reference to granulation and there is no reference to or description of agitation. This patent broadly covers the utilization of the soap reaction in ore concentration as applied to all possible methods of separation, and in the specification the patentees describe all other methods of separation that were known in the art on March 29, 1904, when the application for this patent was filed, except the method of forming the granules and sinking them described and claimed in the first soap patent and except the Elmore process. The specification, in describing the introduction of soap solution and its decomposition with oleic acid with liberation of the fatty acid *in situ* says:

> "The mineral particles now attached to or more or less coated or inclosed by films of fatty or resin acids and the like are capable of being separated from the gangue or earthy particles by various methods dependent upon this altered physical condition" (R., p. 657).

Then follows a description of a method of separation by the chemical generation of carbon dioxide, with which Messrs. Sulman and Picard, assisted by Mr. Cattermole, were then experimenting (R., Sulman, p. 128). Then follows a description of a variant method by causing the metallic particles to adhere to a greased surface, which may be metallic (such as a greased leather or metal belt), and here the disclosure is not of flotation:

> "or the mineral particles may be caused to adhere to metallic or other suitable surfaces coated with similar fatty acids" (R., p. 657).

Then follows a description of another variant method of

separating mineral, by causing it to adhere to greased buoyant material, which will cause it to float :

> " or, finally, the coated mineral particles may be caused to adhere to wood, sawdust, or other suitable material lighter than water coated with similar fatty acids, etc., which can then be removed by flotation " (*idem*).

Thus we have three alternative methods of separation (1) flotation by chemically generated gas, (2) separation by attachment to greased surfaces, (3) flotation by attachment to greased buoyant materials.

The remainder of the specification is substantially the same as that of the other soap patent No. 777,274.

These patents are briefly and fairly described by Dr. Byrnes (R., pp. 100, 101), except for his conclusion that the latter of them describes the production of a metalliferous froth. For this there is no foundation in the patent. Later he applies to the soap and granulation patent the same false reasoning that he applies to Cattermole patent No. 777,273, and reaches the conclusion that the process of metal sinking disclosed in that patent is in fact a process of metal flotation, and then he proceeds to apply the same reasoning to the soap and flotation patent No. 788,247, thereby eliminating the greasy and sticky coating which that patent so well describes and converting it into a disclosure of the minute oil proportions of the patent in suit (R., p. 115). This matter has been already considered under the heading of Cattermole patents (*supra*, pp. 126 *et seq.*). He also refers to a fragmentary statement in the prosecution of the application for this patent that " applicants only seek to coat every particle of metalliferous matter as thinly and evenly as possible " as indicating a disclosure of the minute oil proportions of the process in suit. Obviously, applicants were dealing only with what they knew about and what they disclosed in their patent, and in fact this language was used in differentiation from Everson, wherein all the metallic particles and the gangue are initially coated with oil and agglomerated together in the making of an oily and pasty mass of the whole ore, and then the gangue is washed out with water (R., p. 558). The full statement is as follows :

> "The Applicants never make a pasty mass of the whole ore but only seek to coat every particle of metalliferous matter as thinly and evenly as possible and therefore to keep the gangue and the mineral particles from agglomerating together" *(idem)*.

With soap solution and its chemical decomposition a thin and uniform coating can be obtained upon the metallic particles only without agitation, but this thin coating was expressly stated to be the greasy and sticky coating such as characterized the Cattermole process and would destroy the process here in suit.

Dr. Liebmann considers these statements of Dr. Byrnes and criticises them severely. He says in part that the language in question is

> " only capable of one interpretation, namely, that the object of the patentees was to coat every particle of metalliferous matter as thinly and evenly as possible, as was known at the time, and that was with the quantity of oil used by Cattermole, and disclosed in patent No. 777,273 (R., p. 325).

And further

> " I repeat that this statement, coated as thinly as possible, can only refer to the coating of minerals as was known at the time and not to the coating of minerals which was discovered long after, and disclosed in the patent in suit " (R., p. 326).

He also says

> " No. 777,274 describes the recovery of the concentrates by granulation. No. 788,247 describes the recovery of the oiled particles by skin flotation and refers to any of the well known methods for producing the effect of skin flotation " (R., p. 325).

Dr. Liebmann earlier in his deposition gives an explanation of these two patents (R., pp. 267, 268) and briefly considers them in his summary, considering patent No. 777,274 in connection with Cattermole patent No. 777,273 (R., pp. 331,

332) and separately considering No. 788,247, as to which he says :

> " The quantities of oil used are the same as in the Cattermole patent as a minimum. The phenomenon is skin flotation " (R., p. 333).

Dr. Chandler briefly explains both of the soap patents (R., pp. 370, 371, 378). As to the latter of the two patents he concludes as follows :

> " It is a broad patent for the soap reaction in the concentration of ores, and also specifically for the use of this soap reaction in the flotation processes as then known employing a smaller amount of oil than was necessary to float the mineral by buoyancy. It does not disclose the process of the patent in suit or anything like it " (R., p. 378).

These two soap patents are not referred to in the decision of the Circuit Court of Appeals. It is to be noted, however, that the later of these patents No. 788,247 is not a prior patent. It was issued on April 25, 1905, whereas the process of the patent in suit was invented during the week between March 3 and March 10, 1905, as historically proved by three sets of documents (*supra*, pp. 60 *et seq.*), and the earliest patent record date of the invention of the patent in suit is that of the filing of the application for British patent on April 12, 1905 (R., p. 533 ; Ballantyne, p. 233, p. 218). Under the provisions of the International Convention for the protection of patent property as applied in U. S. R. S. 4887, the filing of the British patent had

> " the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, discovery, or design was first filed in such foreign country."

Should an argument of anticipation therefore be founded on this soap and flotation patent No. 788,247, the rule of law which excludes such a belated patent as an anticipation may be applied with the same force and effect as against the Schwarz and Kirby patents (*infra*, pp. 237 *et seq.*).

Sulman and Picard Patent.

This patent No. 793,808 of July 4, 1905 (printed R., pp. 659-662. *pp. 1204-1206), is not a prior patent. It was copending in the United States Patent Office with the application for the patent in suit and was issued after the filing of the application for the patent in suit. It is not referred to in the opinion of the Circuit Court of Appeals. It is contended that an argument of anticipation cannot properly be founded upon this patent (*infra*, pp. 237 *et seq.*). It discloses a conspicuous failure of Messrs. Sulman and Picard, the patentees of the patent in suit, their efforts to utilize metal flotation prior to the discovery of the invention of the patent in suit.

It appears that the specification of the application for this patent was filed October 5, 1903, and that the drawing was filed December 15, 1903, pursuant to a requirement of the Patent Office, and that the claims were rejected "in view of" the Froment British patent No. 12,778 of 1902, which will next be considered (R., p. 559), and were thereafter allowed, as is proved by the issuance of the patent.

The disclosures of the application for this patent and the patent itself when issued contained no suggestion of any smaller oil proportions than those of the Cattermole process, and, in fact, definitely describe oil proportions which, at a minimum, could not have been smaller than those of Cattermole. The statement is that the particles are

> "moistened by oil or the like" (R., p. 659).

The oil-moistened condition of metallic particles enables them to stick together and form granules, and this is the condition that must be avoided in carrying out the process of the patent in suit. Metallic particles moistened with oil agglomerate together and seriously impair or wholly prevent the procedure of the patent in suit. A reduction of the amount of oil to proportions substantially below those of the Cattermole process is an essential and distinguishing characteristic of the process of the patent in suit.

This patent discloses three different general methods of

procedure constituting three different processes. They are as follows:

First Method. Oiling metallic particles by oil, grease or tar or other material having "a preferential affinity for metalliferous matter over gangue" (R., p. 659); then generating a gas in the mixture by chemical or electrolytic action or by introducing a suitable gas into the mixture. Here it is stated that the amount of oil or the like is

> "insufficient to raise the oiled mineral by virtue of the flotation power of the oil alone" (*idem*).

No apparatus is described for carrying on this method. The result of this procedure, attachment of films or bubbles of gas to the metallic particles and raising them to the surface from which they may be removed by skimming, is described as the common result of the first and second methods. It is to be noted that the specification merely says that the metallic particles are

> "raised to the surface of the liquor by gaseous flotation" (R., p. 660),

and then it is said that the "oiled metalliferous particles" thus raised to the surface of the liquor

> "can then be removed by skimming or other suitable means" (*idem*).

This is a disclosure of the utilization of gaseous bubbles to raise metallic particles to the surface and nothing more. In fact, the gaseous bubbles are weakly attached to the oil-moistened metallic particles with an attachment dependent upon immersion in the liquid, and upon reaching the surface, this attachment ceases, the bubbles burst, and the oil-moistened metallic particle floats, if it floats at all, by skin or film flotation.

Second Method. The oil is not "added alone" (R., p. 660), and the gas afterwards generated in or introduced into the mixture, but the unoiled pulp is treated with a current of air

or gas bubbles carrying atomized oil or the vapor of a volatile oil, and it is said that the oil is

> "reduced to a state of such fine division that minute globules of the same can remain temporarily suspended in an air or other gas current by the use of any suitable spraying or atomizing device and the air-current introduced into the ore-pulp, preferably at the bottom, by means of a pipe or pipes provided with suitable perforations or by other suitable contrivance. The minute oil-globules or the condensed vapors or volatile oils attach themselves to the metalliferous particles in preference to the gangue" (*idem*).

The apparatus shown in Figure 1 (R., * p. 1204) is provided for carrying out this method, "a carburetter or the like C^1" (R., p. 661) being the source of oil or vapor, the air being supplied through the pipe C which includes an injector nozzle arrangement for drawing in the oil in atomized condition. A revolving helical perforated pipe or worm B^1 introduces the oil-carrying air into the pulp. The unoiled pulp is fed from tank A to the pipe A^1. The oiled metallic particles which float are carried by an overflow of liquid into the trough or launder B^4 located "at the end of the tank B farthest from the pulp-inlet * * * to receive the discharge of floating material" (*idem*).

The defendant built an apparatus alleged to be a reproduction of this apparatus (Defendant's Exhibit Apparatus of patent No. 793,808, R., p. 121), and Dr. Byrnes testifies that he tested this apparatus with the coil or worm "rapidly rotated by power, producing a very vigorous agitation" and says that he obtained a thick and satisfactory froth (R., p. 107). He does not supply any analysis of this froth nor give any information as to the oil proportions used. His test was not made in the presence of opposing counsel and objection was made to his testimony as secondary evidence for this reason (R., p. 113). Later complainants' experts made repeated efforts to duplicate Dr. Byrnes' described experiments, using the identical apparatus (Defendant's Exhibit Apparatus of patent No. 793,808) and wholly failed to produce any froth and produced only skin or film flotation. An offer was made to repeat these experiments in the presence

of defendant's counsel and expert (R., p. 340), but the offer was not availed of. In fact this offer was made as to all of Dr. Liebmann's and Dr. Chandler's described experiments (R., pp. 340, 385).

Dr. Liebmann's four experiments with this Defendant's Exhibit are fully described (R., pp. 270, 271). In experiments 1 and 2, for the purpose of testing the efficiency of the apparatus as an agitator, Dr. Liebmann used " quantities of oil suitable for the process of the patent in suit " (R., p. 270). During this test

> " no froth whatever had formed. A skin of about six inches in length could be observed at the end of the vessel " (*idem*).

In the second experiment larger quantities were used, but the same minute proportion of oil to ore, and the result was the same, " very little mineral " being recovered.

In experiment 3 a metallic froth was first formed, in accordance with the process in suit, in a cone mixer. After agitation " a heavy, very excellent froth " was formed on the surface of the liquid, this was sunk by reagitation and the agitated liquid flowed into another vessel in which froth again formed. This again was sunk and flowed into the apparatus put in evidence by defendant as representing that of Figure 1 of patent No. 793,808. Air was blown in and the helix rotated, but only " thin skin flotation " and " no froth " obtained (R., p. 271).

Experiment 4 was carried out with Cattermole proportions of oil and " the result was an aggregation of pasty particles on the surface, which floated as skin flotation " (*idem*).

Dr. Chandler also tested this identical apparatus and could obtain only " a small surface tension float " (R., p. 379). His conclusions are as follows:

> " I could not verify Dr. Byrnes' statement as to this apparatus in any particular. He says that the apparatus is well adapted to oil the mineral and float it as a froth. I found that it was very poorly adapted to oil the mineral and that it did not produce any froth at all. He says that the coiled perforated pipe acts as an efficient agitator to intermingle a considerable

amount of air in the pulp. I found that it simply blew air through the pulp. He says that he obtained a thick and satisfactory froth, of which he skimmed off many handfuls. I did not obtain any froth at all " (R., p. 379).

It may be noted also that the oiling apparatus of the exhibit, alleged to reproduce the carburetor and injector of the patent, was found to be totally inoperative and had to be replaced by a device that would actually feed the oil (R., Chandler, p. 379) and that this oil-feeding device (Complainant's Exhibit, Modified Oiling Apparatus) was used in all the experiments described by complainants' experts (R., p. 386).

Dr. Byrnes' conclusion that the coiled perforated pipe would act " as an efficient agitator to entangle and intermingle a considerable amount of atmospheric air with the pulp," and his further conclusion that the patent discloses " removal of the oiled and aerated metalliferous particles as a froth " (R., p. 101) are obviously founded upon what he says he did in testing his alleged reproduction of the apparatus of Figure 1, and, if honest, are clearly mistaken conclusions.

Third Method. Here gaseous bubbles are not employed at all. A pulp of oiled metallic particles is sprayed through air by a jet of air, so that it will fall upon a water surface, or is thrown out by a revolving disc so that it will fall on a water surface. Metallic particles are expected to remain floating at the surface as a film or skin, and the gangue is expected to sink. Describing this third method the patentees say:

> " We have also found that a particle of metalliferous mineral if coated with a minute film of oil, grease or the like, then exposed to air, will not readily sink in water. It is therefore unnecessary in some instances to employ gaseous bubbles to effect flotation " (R., p. 660).

Again, describing the result of spraying the oiled pulp through air and permitting it to fall upon the surface of the water, it is said

> " The gangue particles wetted only with water at once sink, while the metalliferous particles coated with a thin film of oil and after exposure to air float on the

> surface of the water and may be removed by skimming or other suitable means (*idem*).

Here, therefore, we have skin or film flotation of metallic particles effected without any utilization of bubbles of air or other gas even for the purpose of carrying the oiled metallic particles to the surface and leaving them there, since the oiled metallic particles are mechanically deposited upon the surface and are expected not to sink. If they sink, they are lost.

Defendant's expert barely refers to this third method, but the argument may be made that the use of the words "minute film of oil, grease or the like" or "thin film of oil" appearing only in the description of this third method are intended to describe something different from the condition that the metallic particles are "moistened by oil" appearing in the general description of all three methods. Obviously, however, this description of the condition of the oiled metallic particles in this third or spraying method contains no suggestion of any oil proportion less than Cattermole, and if it did that suggestion would be confined to this particular pulp-spraying process from which all utilization of bubbles of air or gas is eliminated.

The expert evidence describing this patent has been heretofore to some extent considered. Dr. Leibmann's discussion of the patent is exhaustive (R., pp. 268–270) and is followed by his experiments above referred to, the demonstrations of which are wholly contradictory to the testimony of defendant's expert (R., pp. 270–272). Thereafter he epitomizes it in his summary as a

> "skin-flotation process, the skin flotation being produced by a number of apparatus. The quantity of oil must be such that it will moisten the mineral particles; but should be less than is required for buoyancy flotation by the oil alone" (R., p. 333).

Dr. Chandler briefly explains the patent and says as to the several methods or processes disclosed therein that the "result of all these processes is skin flotation" (R., p. 378). As to the apparatus shown in Figures 2 and 3 he says that this is so apparent that no demonstration is necessary, and as to the apparatus shown in Figure 1, he describes his tests of

the defendant's exhibit representing that apparatus (R., pp. 378, 379), as above referred to, and says:

> "I did not obtain any froth at all" (R., p. 379).

He also says that the disclosure of this patent

> "well indicates the groping of Messrs. Sulman and Picard for a practical process of ore separation by flotation. If they had stopped with the ideas disclosed in this patent, they would not have advanced the art in any respect towards the goal which they ultimately attained, with the co-operation of Mr. Ballot.
>
> "The process of the patent in suit is not disclosed in this patent and Messrs. Sulman and Picard might well have been discouraged by the inefficiency and practical uselessness of all that is disclosed in this patent from any further effort to concentrate an ore by flotation assisted by air or gas" (R., pp. 379, 380).

Process of 793,808 in Complainants' Laboratories. The fact that efforts were made to utilize air and gas flotation with metallic particles moistened by oil during the research period of complainants' metallurgists preceding the discovery of the process of the patent in suit, has heretofore appeared (*supra*, pp. 61 *et seq.*). This method of ore concentration was invented by Messrs. Sulman and Picard in July, 1903, before they learned of the existence of the Froment generally similar invention. Mr. Picard describes the floating concentrate obtained as of very feeble and tender character and "of such a nature that extreme care had to be used in its collection" (R., p. 153, Q. 67). He attributes the difference between the floating materials obtained according to this patent No. 793,808 and those obtained by the process of the patent in suit "largely to the greater quantity of oil that was used" and says that the oiled mineral was "of the Cattermole variety" and that

> "In our experience air introduced in the manner shown in Figure 1 does not attach itself very readily to these particles of mineral heavily oiled, and though the air did, to a large extent, carry the mineral flocks to the surface, they, the flocks, seemed to sink again with ease

in such a manner as to suggest that the air which caused them to float had freed itself from the particles" (R., p. 153, Q. 68).

Further, although he attributes non-success to the use of "too much oil" he says :

> "I do not think success would have been obtained with this particular apparatus, even though the quantity of oil had been much reduced" (R., p. 154, Q. 70).

Mr. Chapman also describes tests of this process, which was known as the bubbles process, in the laboratory, and the construction of a small glass apparatus of the type shown in Figure 1 of patent No. 793,808, and its use in treating tailings of the Cattermole process, and with air pumped into the perforated spiral (R., pp. 182, 183). This was not the disclosure of the patent, since the metallic particles present had all been thoroughly oiled before they entered the apparatus. He rotated the worm slowly, thus gently distributing the air through the pulp, and floated some of the flocks of stickily coated metallic particles, and he even says that the results were most encouraging, but evidently they were not sufficiently encouraging to lead to any practical results. He further says that in testing this apparatus he always operated upon tailings from the Cattermole process and never upon crude ore, and that he never attempted to use the apparatus as an agitator, as indeed violent rotation of the worm would have broken the apparatus (R., p. 200, including x-Qs. 175, 176).

He did actually test the second method of patent No. 793,708, as well as the third method of that patent, with crude apparatus as follows :

> "Another type of apparatus used took the form of an ordinary scent spray. This apparatus was used in several manners. First it was used to force finely disseminated oil into a vessel containing crushed ore and water. This method of bringing about oil attachment to the sulphide mineral proved to be very poor. Second, a pulp of crushed ore and water, which had been suitably agitated with oil, was placed in the scent spray. The pulp was sprayed on to the surface of still water.

A separation of the sulphide mineral from the gangue was quite apparent, the mineral floating by means of the well-known oiled needle effect and the gangue sinking through the water" (R., p. 183).

Mr. Ballantyne refers to this apparatus as having been operated in his presence, and says there was a distinct tendency for bubbles of air to attach themselves to the flocks of metalliferous mineral and bear them to the surface (R., pp. 222, 223). He further says:

"My clients made heroic efforts to get some sort of practical results from the Sulman and Picard bubbles process, or from the Froment process, but without success. * * * In a laboratory where one can nurse the small quantities of materials dealt with, it is sometimes possible to get indications of a separation of oily flocks of mineral by the Froment process or by the Sulman and Picard bubbles process described in the United States patent No. 793,808, and in 1903, the results were sufficiently promising to justify my clients in applying for patents, but nothing practical could be made of these processes" (R., p. 223).

Mr. Sulman also testifies as to tests of this process (R., p. 128) and generally describes numerous laboratory tests thereof (R,, pp. 134, 135) and says:

"Our success in these operations was of a very imperfect nature, and our specification rather represented a pious hope that we should ultimately attain success in these lines. * * * After a considerable amount of time and experiments, we discontinued our efforts in this direction, owing to the small degree of success experienced and from the apparent improbability of such processes developing into a commercial method for mineral separation from gangue. The quantities used of oily matter were always substantial, that is to say, they would always be in excess of one per cent upon the ore taken. At that time we had no knowledge of the effective use of quantities of oil below the proportions employed by Cattermole, and regarded these Cattermole quantities as being likely to be required in flotation work of the nature we were experimenting upon" (R., p. 135).

Froment Patents.

The Froment British patent No. 12,778, dated June 4, 1902 (printed R., pp. 706–709) was granted to Henry Harris Lake as a communication from Alcide Froment of Traversella, Italy, and is effective as a patent as of its sealing date, which is stipulated to be August 18, 1903 (R., p. 283).

This patent was put in evidence by the defendant during the deposition of Dr. Byrnes, who also referred to the corresponding Italian patent, stating that this British patent corresponded to Froment's "Italian patent No. 63,723" (R., p. 103), but he avoided any further reference to the Italian patent, and defendant did not put it in evidence, and it was offered in evidence in rebuttal by complainants (R., p. 283; printed pp. 471, 472) and also a translation thereof (R., p. 283; printed pp. 472–474). The patent is numbered 63,723, and the specification is dated May 20, 1902. No other date appears on the document and it may be treated as effective from the day of its date.

When the British patent became a published document on its issuance or sealing on August 18, 1903, Mr. Sulman saw a publication describing it (R., p. 128) and learned thereby that Froment was an earlier inventor of the broad idea of floating oil-moistened metallic particles by air or other gas which had been invented by himself and Mr. Picard. He at once called this to the attention of his associates (R., pp. 140, 141). This is corroborated by Mr. Ballot (R., p. 165) who personally negotiated the purchase of Mr. Froment's patents at Milan, Italy (R., p. 170). The assignment, dated November 17, 1903, is in evidence (R., p. 170; printed pp. 468–470). The consideration as stated in the assignment, was £225 sterling (R., p. 469), or a little more than a thousand dollars. This included the British patent and patents in all countries except Italy for any improvements, and the assignment contained a covenant that Froment would communicate all improvements and "the plans and diagrams of the plant relating to such improvement or improvements with full descriptions of the working of the same." It was in pursuance of this covenant that the Froment description next to be considered, which describes

Froment's improvements upon what his patents disclose, was delivered to complainant Minerals Separation Ltd.

The British patent and the Italian patent are so nearly alike that it is quite evident that the British patent, which is the later document, is a translation of the Italian patent, with such modifications in the direction of indefiniteness as a British patent agent would make from force of habit. The British provisional specification is almost a literal translation of the Italian specification. Of course the Italian claim is not repeated, because a provisional specification is characterized by the absence of claims. The British complete specification repeats the identical language of the provisional specification except for the opening paragraph and the claim. It is only necessary, therefore, to compare the specification of the Italian patent with the complete specification of the British patent in order to discover the slight differences in wording between the two documents.

The opening clause of the British complete specification, which does not appear in the Italian specification, is as follows:

> "This invention has reference to the concentration of metalliferous ores and earths for the purpose of separating and recovering therefrom the finely divided metal or metallic compounds, and consists of a modification of what is known as the oil process of ore concentration" (R., p. 707).

The oil process of ore concentration then known, and widely known, was the Elmore oil-buoyancy flotation process, and it was the only oil process of ore concentration known in the practical art.

The following evidence of Mr. Ballantyne stands uncontradicted:

> "In 1902, the 'oil process of ore concentration' referred to by Froment was the Elmore bulk-oil process, which was the only one publicly known or tried on the commercial scale. * * * The Elmore bulk oil process was tried at the Traversella Mine in Italy where Mr. Froment was the engineer" (R., p. 236).

Dr. Leibmann explaining Froment's patent testifies:

> "The only process known as the oil process of ore concentration at that time was the Elmore oil buoyancy flotation process" (R., p. 283).

Dr. Chandler also, in describing the Froment patent, refers to

> "what was then known as the oil process of ore concentration, to wit: the Elmore bulk oil buoyancy flotation process" (R., p. 373):

Froment, therefore, was endeavoring to improve upon the Elmore process, with which he was undoubtedly thoroughly familiar, and that fact is helpful in the effort to understand the vague and indefinite disclosures of Froment's patent. For example, Froment's only disclosure as to oil proportions is that he uses

> "a thin layer of ordinary oil" (R., p. 706)

in an experiment carried on in a test-tube with minute quantities of material (less than half an ounce of ore), which is in fact the only disclosure of these specifications. The Elmore oil layer in such a test-tube would be an inch thick when present in the Elmore minimum proportion, 100 per cent. of the ore (R., Chandler, p. 368). The ordinary oil of what was then known as the oil process of ore concentration was thick petroleum residuum oil (R., Chandler, p. 371; Liebmann, p. 354).

Dr. Chandler, after stating this, testifies as follows:

> "Therefore, in my opinion, it is a reasonable interpretation of the meaning of the statement 'a thin layer of ordinary oil,' that a layer from an eighth of an inch to a quarter of an inch in thickness of thick residuum oil is described" (R., p. 372).

Dr. Chandler says that Froment by "ordinary oil" described the "thick viscous oil of the Elmore process" (R., p. 356), and that Froment describes a layer of oil in such a test-

tube not less than one-eighth of an inch in thickness (R., p. 356, RdQ. 224).

Dr. Chandler further testifies to the determination by test of the thinnest possible layer of such an oil on water in such a test-tube (R., p. 374, Experiment 1). He further says:

> "The thinnest possible layer of this thick residuum oil requires a quantity of oil 11.7 per cent. of the ore, 42 drops, equivalent to 1.3 cc., but Froment evidently did not mean to describe the thinnest possible layer, but only a layer which would be thin as comparable with the inch thick layer of Elmore" (R., p. 372).

He further testifies that the oil which he used in this particular experiment is about the thinnest residuum oil known in the art of ore treatment, to wit: Winter Dark oil, and that the other residuum oil, Summer Dark oil, is thicker and required 14.4 per cent. of oil to make a layer on water in such a test-tube (R., p. 383, Q. 126).

Mr. Chapman repeated this test with Winter Dark oil in London during the winter and found that the proportion which made the thinnest possible layer was 12.6 per cent. of the ore (R., p. 392).

Dr. Liebmann's determination was 12½ per cent. as the thinnest possible layer (R., p. 287). We may therefore take an oil proportion of 11½ per cent. as less than the absolute minimum of the disclosure of the Froment patents. This is 230 pounds to the short ton of ore.

In this connection defendant endeavored to confuse the issue by requesting Dr. Liebmann to determine the thinnest possible layers in such a test-tube of a number of oils which never could have been used in the Elmore process. Dr. Leibmann did this, obtaining as small an amount as .15 cc. with sweet pine oil and turpentine (R., p. 354) which determined on the specific gravities (R., p. 385) give proportions of 1.41 per cent. and 1.3 per cent. These proportions are about the lowest proportions of the Cattermole process, and are not usable in the process in suit, but obviously they could not be the disclosure of the Froment patents.

In this connection it is to be noted that the claim of the Froment Italian patent throws some light on the inventor's

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conception as to the nature of the oil to be used in his process, in that he states that gases are to be used in combination

> "with an oily fat body (and not with an oily body derived from bitumens, tar, naphtha, etc.)" (R., p. 474).

This excludes practically all the oils tested by Dr. Byrnes at the request of defendant (R., Chandler, p. 373). As Dr. Chandler says :

> "It excludes the lighter distillates of petroleum, naphtha, etc., but thereby includes thick residuum oil. Whatever he had in his mind, he described a thick oil and as petroleum residuum was then used in the art as the ordinary oil for concentrating ores, I think it is evident that he meant to describe this petroleum residuum" (*idem*).

It may be further noted that Dr. Liebmann, in reaching his conclusion that 12½ per cent. was the smallest amount of oil that would make the thinnest possible layer on water in the appropriate test-tube for the Froment disclosure of a test-tube test, made this determination as to the oils which Dr. Byrnes had used in his experiment alleged to carry out the Froment patents (R., p. 354), to wit, cottonseed oil, olive oil and oleic acid. Therefore, as to all the oils which defendant's expert deemed described by the Froment patents, as well as to the Elmore oil which seems to be reasonably indicated, the minimum amount for the thinnest possible layer such as Froment described is more than 11½ per cent., or 230 pounds of oil to the short ton of ore.

The only disclosure of a procedure for the concentration of ores in the Froment patents is, as above noted, a description of an operation in a test-tube with 10 grams (less than half an ounce) of ore. This description in the British patent is as follows :

> "Thus for example, if in a test tube there is placed say ten grammes of sulphuretted copper ore with its gangue, a gram of limestone, the whole reduced to powder, and if there is added thereto thirty grammes of water, a few drops of sulphuric acid and a thin layer of

ordinary oil, and the mixture then agitated for a brief space, the whole of the chalcopyrite will instantly rise to the top of the liquid. The metallic spherules, pressed one against the other, will become grouped in a magma clearly separated from the rest of the liquid. If the limestone is in excess or readily attackable, the rapidity of the separation is so great that the chalcopyrite is forcibly projected outside the vessel. There is therefore a proportion to be sought for a given ore and limestone.

"The small quantity of gangue mechanically conveyed gradually falls and the sulphides remain in a state of almost complete purity. Such is the principle" (R., pp. 706, 707).

Such a disclosure cannot be seriously treated as a process for the concentration of ores, wherein a plant dealing with 50 short tons or 100,000 lbs. of ore a day is the smallest thinkable commercial plant. In the United States Patent Office the Froment application would have been rejected and the requirement have been made that a practical process of concentrating ores be described. Evidently Froment had observed this interesting phenomenon in a test-tube, and hoped that from it a process of concentrating ores might be evolved. That hope was never realized. The momentary and frequently explosive action which he here disclosed was wholly incapable of use.

The description of the time of agitation in the British specification is that the test-tube is "agitated for a brief space." In the Italian specification the corresponding expression is "agitated for a second" (R., p. 473), and a test of his disclosure shows that this is what he meant, as agitation for a second gives the maximum result in mineral flotation attainable in a test-tube in accordance with this disclosure.

The meaning of this disclosure is that Froment put his materials in the test-tube with a quantity of oil at least 11½% of the ore (230 lbs. to the short ton of ore), enough sulphuric acid and limestone to produce almost an explosive generation of carbon dioxide, shook it for a second, and then the generated carbon dioxide floated a fair proportion of the metallic particles to the surface in a thick magma or paste within which was entrapped some of the gas. Dr. Chandler repeated this test with the ordinary oil of the Elmore process,

gave the test-tube five shakes, which occupied a second, and obtained a floating magma which was an inch in thickness, with fairly clean tailings (R., p. 374, Experiment 1). He then shook the test-tube for another second. The magma diminished about half and many of the metallic particles subsided. He then shook it another second and the magma diminished to a quarter of its original dimension. He then shook it for a fourth second and found that his float was nearly all oil, while the tailings contained practically all the metal (*idem.*).

This is what Froment disclosed, and all that he disclosed in either of his patents, with the exception that he used more oil than the thinnest possible layer used by Dr. Chandler. Dr. Chandler says :

> " Froment had but one idea, and that was to float the mineral by carbonic acid generated chemically, and he has disclosed in this patent a very interesting and fairly effective test-tube operation, which, if carried out in accordance with his directions, is successful, but which, with a too long agitation, fails, because of the escape of the generated and liberated gas " (R., p. 372).

Dr. Chandler further says as to the Froment patents :

> " The only definite disclosure of either of these patents is of a test-tube operation. The remainder of the patents is theory and speculation. Each patent itself describes the only definite disclosure in it as an example of the principle, and the Froment patents are, in fact, patents for a principle, not worked out into any practical or useful process " (R., pp. 373, 374).

The word " magma " which Froment uses is interpreted by Dr. Byrnes as describing a froth (R., p. 103, paragraph (6)). This is erroneous. It means a paste. The exact meaning is as follows :

> " Magma is the generic name of any crude mixture of mineral or organic matters, in a thin, pasty state " (R., p. 332).

This is the definition in Ure's Dictionary of Arts, Manufactures and Mines, and this definition is substantially re-

peated in Murray's Dictionary and in Webster's International Dictionary, referring to Ure as their authority (*idem*).

Dr. Byrnes admits that the Froment British patent describes the separation of the oil from the concentrates for reuse (R., p. 103, paragraph 7). While this in itself may not be instructive, it is associated with a description which clearly indicates that the oil is to be recovered from the concentrates by squeezing it out of a mass of oil and concentrates in a press, and this indicates a very large amount of oil, greatly in excess of Cattermole proportions. The Italian Froment specification says:

> "The products of the concentration form oil cakes" (R., p. 473).

The British specification says:

> "The products of the concentration form cakes" (R., p. 707).

This clearly indicates that pressure has been used to extract the oil, as Dr. Chandler testifies:

> "This indicates that the oil is recovered in a filter press, as suggested in the Elmore patent No. 676,679. As such procedure does not recover all the oil, his statement is quite accurate. His concentrate would be in the form of oil cakes, the particles of the concentrate adhering together by reason of the oil left in contact with them" (R., p. 372).

Dr. Liebmann testifies that this is the meaning and says:

> "it is impossible by the use of filter presses and similar apparatus to squeeze out all of the oil from a mass of minerals and oil. At the best, from 8 to 10 per cent. will be left with the minerals" (R., p. 289).

Dr. Chandler's full consideration of the Froment patents (R., pp. 371–376) concludes and sums up a considerable amount of testimony, including elaborate cross-examination in behalf of defendant relative to these patents.

Dr. Liebmann explains these patents exhaustively (R. pp. 283–289) and then summarizes briefly (R., p. 289) and then in

his summary of the prior art he again briefly considers these patents (R., pp. 332, 333) and in part says:

> "The result is obtained by oil-buoyancy flotation assisted by gas bubbles enclosed therein" (R., p. 332).

There remain to be considered certain tests made by Dr. Byrnes, alleged to be illustrative of or in accordance with the Froment British patent, but in fact in no way related to the disclosures of that patent.

The first series of seven experiments (R., pp. 103–105) resemble the Froment disclosure in the fact that they were made in test tubes, but in no instance was the Froment procedure followed.

(1) The first test was with water alone, which was well agitated to produce air bubbles, which immediately rose to the surface and escaped. Obviously this does not illustrate Froment.

(2) This experiment was repeated with a drop of defendant's oleic acid added to the water. Violent agitation produced an emulsion of oil and water, which rose to the surface and lost its air. This, again, is not illustrative of Froment.

(3) Here the defendant's ore, finely powdered, was added to water and well shaken, resulting in a slight and negligible flotation of the particles. This, again, does not illustrate Froment.

(4) A few drops of sulphuric acid were then added to the mixture of ore and water of experiment 3, and the mixture was heated, and thereupon it is said gas was chemically liberated and carried considerable mineral to the surface, which, however, quickly sank. This is not Froment. Froment, like Elmore, altogether avoids the use of heat. It was as described, a Potter and Delprat experiment, and demonstrated the evanescent character of the floats produced by carbonic acid gas bubbles alone. By this procedure the chemical operation generating the gas, carbonic acid, which Froment relies upon, was exhausted, and the gas permitted to escape.

(5) A drop of olive oil was now added to the contents of the test-tube and the tube was agitated, evidently very violently. Dr. Byrnes says that this brought about the flota-

tion of "a large mass of oil and aerated mineral * * * in the form of a magma or froth having the characteristics described in the Froment patent." The remarkable thing about this test was that flotation by chemical gas generation of oil-moistened particles, which is the sum and substance of the Froment disclosures, was absolutely impossible because of the prior exhaustion of all gas generation. Moreover, instead of using a thin layer of oil, which would be at least 42 drops (R., Chandler, p. 372), Dr. Byrnes used just one drop of oil. But even this was enough to destroy any operation of the process in suit, since for 10 grams of ore the oil proportion of the process in suit is from "one-fourth to one-sixth of a drop" (R., Liebmann, p. 297). Moreover, he heated his mixture, and the Froment patents do not mention heat. Further, Dr. Liebmann endeavored to repeat the experiment and could not obtain the result described by Dr. Byrnes (R., pp. 295, 296).

(6) Here the dry ore was oiled without agitation by moistening it with ether, in which two drops of oil had been dissolved; then the ether was evaporated, leaving the oil adhering to the ore; and then the oil and ore was placed in the test-tube with water and sulphuric acid and was heated.

This experiment is obviously in no way related to the disclosures of the Froment patents and is criticised by Dr. Liebmann (R., p. 299), who epitomizes the Froment test-tube example by way of contrast.

> "The Froment test-tube example is simple. Mix 10 grams of ore with one gram of calcite, and sulphuric acid, then a thin layer of oil, agitate for a second and the concentrates will be on the surface of the liquid in the form of a magma" (R., p. 296).

(7) Dr. Byrnes' experiment 7 describes two experiments, which are the closest approach of anything that Dr. Byrnes did to the Froment disclosure. The use of heat, however, was wholly unwarranted, and the necessity for its use indicates that the Froment disclosure was departed from. Dr. Byrnes here indefinitely says that he used "a thin layer or a few drops of olive oil" (R., p. 105), whereas, as Dr. Liebmann points out, "a thin layer required * * * anything from 49 to 63 drops" (R., p. 296). Again, the oil used, olive oil,

was certainly not the ordinary oil of the oil process of ore concentration then known to the art, to wit, the Elmore oil-buoyancy flotation process.

Dr. Byrnes further testifies to five experiments in a modern slide machine, wherein he says he "operated the process of the Froment British patent" (R., p. 107). As to [illegible] of these experiments it is perhaps enough to say that for 492 grams of ore he used 1 cc. of sulphuric acid. This was capable of producing only eight-tenths of a gram of the gas carbonic acid, which, if generated, would have been immediately dissolved in the water, as enough water was present to dissolve "four times the quantity of carbonic acid which could have been generated if all the sulphuric acid had been consumed" (R., Liebmann, p. 301). Further

> "The agitation in the slide machine would assist the solution of the carbonic acid in water considerably and would put it practically out of action for the purpose and the duty which Dr. Byrnes alleges it performed" (*idem*).

This agitation in this most highly efficient small scale agitator and froth separator of the present day was at the maximum speed of 1,600 revolutions per minute, as admitted by Dr. Byrnes (R., p. 122). Under these conditions with a minute amount of sulphuric acid, which probably was so diluted that it did not act chemically at all, and if it did could only have produced a trifling amount of gas which would have been immediately dissolved in the water, Dr. Byrnes pretended to carry on the process of this Froment British patent, which relies exclusively upon the flotative effect of carbonic acid gas produced by the chemical action of sulphuric acid. It will be seen that Dr. Byrnes took the greatest care to prevent any possibility of reproducing this Froment disclosure.

In the first of these spurious Froment experiments in the slide machine Dr. Byrnes used .3 cc. of cotton-seed oil, which is roughly 1.1 pounds per short ton of ore (R., Liebmann, p. 301) or .05 per cent. of the ore. With this minute proportion of an oil not practically suitable for the process of the patent in suit (R., Chapman, p. 394, Q. 257), he carried on the process of the patent in suit in an apparatus peculiarly

adapted for that process, and by five successive agitations and froth removals, he obtained a concentrate containing 50 per cent. of zinc from an ore containing 20.3 per cent. of zinc, but with a rather large zinc content of 4.2 per cent. in the tailings (R., pp. 107, 108).

In the second of these experiments the oil proportion was multiplied by 66 (R., p. 108) and amounted to 73 lbs. per ton (R., Liebmann, p. 303), or about 3.6 per cent. There were six successive agitations and removals of the floating material, and this floating material was a concentrate containing 48.3 per cent. of zinc, of lower grade than in experiment 1. The tailings contained 1 per cent. of zinc (R., p. 108), although the recovery on Dr. Byrnes' figures was more than 100 per cent. (R., p. 299), an impossible result.

As above noted, this procedure had no relation to any of the prior patents or disclosures. The fairly good concentration produced by careful manipulation of this laboratory operation is totally incapable of reproduction on a practical scale. The evidence shows that the larger the operation the poorer the result, as demonstrated by the tests hereafter fully described (*infra*, pp. 198 *et seq.*). The procedure carried on was the invention of Dr. Byrnes in the light of the knowledge of the present day, but it was worthless.

Three more of these tests are described, one using 3.6 per cent. of olive oil and fairly successful in this miniature operation, another using the same proportion of defendant's oleic acid and a failure by reason of incipient Cattermole granules or " flocks " which in this instance could not be rescued from the tailings, and the last using 1.8 per cent. of a purer oleic acid with fairly good results in this small scale operation (R., p. 108) but useless on any practical scale, as was later demonstrated. The oil proportions were Cattermole proportions, as Dr. Liebmann demonstrated by experiments with this ore and this oil (R., p. 307, Experiments 1 and 2). That you may in small scale manipulations prevent the formation of granules and float oily masses with air entangled therein, is an interesting fact, but it is wholly irrelevant. We are here concerned with processes for the concentration of ores, and not with laboratory manipulations.

Dr. Liebmann by way of illustrating the fact that these experiments of Dr. Byrnes have no relation to the disclosure of

The Froment patents carried on a series of test-tube experiments in which he translated the quantities used by Dr. Byrnes so far as possible to the corresponding quantities for test-tube experiments such as Froment disclosed, and in each instance the operation was a failure (R., pp. 297–299). Dr. Chandler also three times carefully repeated these test-tube translations of Dr. Byrnes's slide machine tests and they failed in each instance (R., pp. 374–376, Experiments 3–17).

It seems remarkable that Dr. Byrnes in twelve experiments, seven in test-tubes and five in the slide machine, did not, in a single instance, follow out the procedure disclosed in the Froment patents. The reason is that a single honest experiment would have exposed the error of his conclusions.

Dr. Liebmann exactly repeated the disclosure of the Froment patents. His first experiment resulted in such explosive gas generation that the contents of the test-tube were ejected (R., p. 286), but using precautions he was able to reproduce it and to obtain the magma or paste with entrapped gas bubbles which Froment describes (R., p. 286; p. 347, x-Q. 101). Dr. Chandler also exactly reproduced it, obtaining the magma or paste, which, after a second's agitation, was an inch thick, after two seconds' agitation half an inch thick, and which dropped all its metal after it had been shaken four seconds (R., p. 374, Experiment 1).

For the information of the Court it was thought advisable to approximate the Froment disclosure so far as possible in the modern slide machine. These experiments are described by Mr. Chapman (R., pp. 392, 393). He used the ordinary oil of the Elmore oil-buoyancy flotation process. By his own test he determined the smallest amount of oil that would produce a layer on water in a test-tube such as Froment described. He found that this was 41 drops, or 12.6 per cent. of the ore, and he used this proportion. In his first experiment he used the normal quantity of ore for a slide machine test, but the magma was more than 7½ inches thick and overflowed at the top of the machine. He then reduced the amount of material treated and obtained a floating magma which stayed in the machine and which subsided to a thickness of about four or five inches. Then he took a sample of the gas in this magma and analyzed it and found that it contained about 97 per cent. of

carbon dioxide (R., p. 393). This is what Dr. Byrnes would have obtained had he fairly applied the Froment disclosure in using the modern slide machine, and verifies the statement of Froment that his float is produced by the carbon dioxide liberated from limestone by the chemical action of sulphuric acid.

Perhaps the best summary of the Froment patents is in the following answer of Dr. Liebmann :

> "To be quite frank, I do not find any practical process in the Froment document. There are the four principles which would suggest working in a number of steps. Then there is again a suggestion at the end of example 2, from which one can infer that he might mean the process to be in a sequence of steps. And then there is the claim, which again claims only a sequence of steps. Yet, there is no description of any process containing or being based on a sequence of steps. The only process I find is a test-tube example, and that is not a practical process" (R., p. 346, x-Q. 96).

In the opinion of the Circuit Court of Appeals, it is in relation to these Froment patents that the Court says :

> "A paper patent, if it fully describes an invention, whether it be a machine, device or process, is just as effective to show anticipation as a patent which describes an invention which has gone into extensive use, for a presumption of operativeness and of some utility attends the granting of letters patent" (R., p. 719).

It is quite evident that it cannot be said of the Froment British or Italian patent that "it fully describes" the invention of the process in suit. It is quite evident also that since it only describes a test-tube experiment with less than half an ounce of ore, the only presumption that could attend the granting of such a patent would be that the little test-tube experiment was capable of reproduction. As a matter of fact the cases cited refer only to the presumption which attends the granting of a patent in the United States, wherein the Patent Office rejects applications containing incomplete, inoperative or useless disclosures, and Froment had no patent in the United States.

No such presumption arises either as to the British or Italian patent. But the climax of error in the application of the law appears in the following quotation from the opinion in the Telephone cases (126 U. S., 1, 536), wherein this Court said as to the disclosures of the fundamental Bell telephone patent protecting an invention which created the art of electric telephony, that it was not necessary that the discoverer or inventor, in order to get a patent, "must have succeeded in bringing his art to the highest degree of perfection." This Court further said:

> "It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way of putting it into operation."

Obviously Froment in these patents did not point out any practicable way of putting his invention into operation.

The remaining consideration of these patents in the opinion of the Circuit Court of Appeals is first a repetition of the test-tube example (R., p. 717), and then a reference to the Froment description (R., p. 718), which describes something wholly different from what is disclosed in the Froment patents, and thereafter a blending of the patents and the description in something described as the Froment process. This will be considered in the next heading, and it is only necessary here to note the statement that

> "Froment recommends the use of ordinary oil or a suitable oil" (R., p. 718).

The words "suitable oil" are taken from the claim of the Froment British patent (R., p. 709), which is obviously not a disclosure, but a statement of what the inventor deems to be within the scope of his invention. Without any question the only disclosure that Froment makes in his patents is of the use of the ordinary oil of what was known in his day as the "oil process of ore concentration", to wit, the Elmore oil-buoyancy process.

Confusion of disclosure of specification and scope of claim. The error of the court below in confusing the rule of law as to

anticipation and prior art with the rule of law as to infringement, has appeared also in Judge BRADFORD'S recent decision hereinafter considered. It is believed that for the guidance of the lower courts a clear exposition by this court would prevent further confusion as to the law on this subject. The law is well settled that a prior patent is effective by way of anticipation of a later invention only as to what is clearly shown in the drawings or described in the specification of the prior patent, or both shown and described, *i. e.*, what is clearly disclosed in the patent. True the claims of the prior patent may be referred to for assistance in the comprehension of the disclosure, but it is the disclosure that counts and not the scope of the claims. The claims should be as broad as the invention and should cover and include all future improvements which may be within the scope of that invention, *i. e.*, which may embody the same broad idea of means and yet may additionally include subsidiary improvements. As this court said in Smith v. Nichols, 88 U. S., 112, 119 :

> "A new idea may be ingrafted upon an old invention, be distinct from the conception which preceded it, and be an improvement. In such case it is patentable. The prior patentee cannot use it without the consent of the improver, and the latter cannot use the original invention without the consent of the former."

In such case the improvement is within the scope of the claim of the primary invention, but it is not and could not be disclosed in the patent for the primary invention. It must be specifically new—priorly undisclosed—to be patentable. Applying this law to the case at bar Froment disclosed an oil which he described as the ordinary oil of the oil process of ore concentration, but in his claim he pointed out that his invention consisted in mixing the powdered ore with water, " adding *a suitable oil* and then liberating a gas in the mixture substantially as described and for the purpose specified" (R., p. 709). Thereby he announced that he regarded as within the scope of his invention the use, in a process such as pointed out in this claim, of any oil that any one else might thereafter discover to be suitable for use therein; in other words, he did not limit himself to any particular

oil. But he did not thereby alter the disclosure of his specification, and he did not thereby anticipate all discoveries of future inventors as to the peculiar qualities and characteristics of oils not disclosed by him when used in the process or combination pointed out in his claim.

So in the patent in suit the specification discloses a specific process which requires acid and heat, but certain claims (1, 9 and 12) are broad enough to cover the use of the broad invention—air-bubble separation in the presence of a minute amount of oil—whether or not heat and acid are employed. A subsequent inventor may well have discovered that for certain ores and with the use of certain oils, the omission of heat and acid contribute beneficially to the result. This new idea ingrafted upon the old invention may be patentable as an improvement. Yet it is clearly within the scope of the broad claims of the patent in suit, namely, claims 1, 9 and 12.

So also the scope of the broad claim of the Bell telephone patent included the whole art of electric telephony, yet thousands of patents were thereafter granted for improvements in that art, which remained subsidiary to and dominated by the master patent until the master patent expired.

It is submitted that when the court considers a question of infringement the claims of the patent in suit are to be principally referred to; the function of the specification is to explain the claims; and that when the court considers a patent as an anticipation or as prior art the specification and drawings are primarily and usually are alone to be considered; the function of the claims can only be to assist in comprehension of the disclosure of the specification and drawings, and their function cannot be to broaden that disclosure (as a disclosure) to the scope of the claims.

Froment Description.

This private document (printed R., pp. 406–409; translation, pp. 409–414; drawings, * pp. 1056, 1057) is dated December 29, 1903, more than eighteen months after the date of the Froment Italian specification (R., p. 474), and of the filing of the Froment British application, and more than nine

months after the filing of the British complete specification (R., p. 706). It was delivered to the complainant Minerals Separation, Ltd., in the latter part of December, 1903 (R., Ballot, p. 167), and with it the experimental apparatus described in the document.

It does not describe the procedure disclosed in the patents, but evidently describes the improvements upon that procedure which Froment had made in the period of eighteen months which had elapsed since the filing of the applications for these patents. The most notable fact as to these improvements is the reduction of the quantity of oil used from the minimum of 11½ per cent., or 230 pounds to the short ton of ore, of his patents, to a minimum of one per cent., or 20 pounds to the short ton of ore, recommended only for a very lean ore in the description. This reduction in the quantity of oil used was, however, accompanied by a complete reorganization of the procedure.

We first have elaborate instructions for the de-sliming of the ore—separating all the "impalpable" metallic and gangue particles—

> "eliminating the slime which is too fine to be treated" (R., p. 411),

in contrast with the process in suit wherein the slimes are helpful, usually necessary, can be treated either alone or with coarser material, and the valuable constituents of the slimes are saved (*supra*, pp. 39, 40). Indeed Froment confesses the inability of everything known, in his day, as well as his own procedure, to treat slimes, saying:

> "eliminating the slime which is too fine to be treated and which could not be treated by any hitherto known method" (R., p. 411).

In this connection it is to be remembered that Froment was a mining engineer at the Traversella mines in Italy where the Elmore oil-buoyancy flotation process—the only process employing oil that had gone into commercial use—was in actual operation (R., p. 236).

The ground ore, thus deprived of its slime, is then agitated in a mixing vessel with oil and limestone, so that "all the

sulphide grains" (metallic particles) shall "come into thorough contact with the oil" (R., p. 411).

The quantity of oil ("mineral engine oil", a thick lubricating oil) varies from 1 per cent. for a very lean ore to 3½ per cent. and higher for richer ores, and it is said that

> "the proportion of the carbonate of lime follows practically the same rule, for a richer ore will require more gas than a poorer one" (R., p. 412).

Thus the expenditure in oil and sulphuric acid is "in proportion to the richness of the ore" (*idem*), in strong contrast with the process in suit wherein there is no relation between oil proportion and richness of ore (*supra*, p. 42).

The contents of the mixing device are, in the experimental apparatus, directly emptied into a "vat with coil", but, in the large scale apparatus illustrated, intermediate vessels are provided to receive the charge, from which it may be flowed as required into a separate vessel or "vat with coil". These intermediate vessels 7, 7′, are shown in the drawings (*p. 1056) and described thereon as follows:

> "7, 7′. Vessels receiving the ore after the centrifugal mixing."

The separating vessel has a gentle stirring device

> "so as to prevent the ore from collecting at the bottom in too compact a mass" (R., p. 412).

We now have the ore pulp with its metallic particles moistened by oil, limestone mixed with them, and the pulp gently stirred so as to prevent the ore from settling at the bottom in too compact a mass. Under these conditions there would be absolutely no flotation, as was demonstrated by experiments made by Dr. Liebmann and Dr. Chandler in a reproduction of the Froment experimental apparatus and in other apparatus (R., Liebmann, pp. 320–322; Chandler, pp. 377, 378).

The next procedure, however, produces some flotation. "Sulphuric acid is introduced" (R., p. 412) through a lead pipe or coil in the "vat with coil," the acid attacks the lime-

stone, gas is liberated and metallic particles are floated up to the surface thereby and usually left there by the bursting gas bubbles to float by skin flotation or to sink. The description says :

> " As soon as the acid has reached the vessel and begun to mix with the ore, the reaction will at once begin, and the greatest part of the greased sulphides will rise to the surface, carried by the gas bubbles. They are skimmed or pushed into a small hopper which forms an overflow for the vat " (R., p. 412).

The description also says that—

> " a small proportion falls back and gets mixed with the gangue " (*idem*).

and for the separation of these reliance is had upon subsequent treatment in a " purifying screen ", of which it is enough to say that it was a wholly useless device which did not aim to utilize flotation.

Finally it is stated that

> " The concentrated ore may be subjected to treatment by a hydraulic press or filter press, and by that operation a very large proportion of the oil used can be recovered " (R., p. 413).

This statement may well be contrasted with the condition of the concentrates of the process of the patent in suit, wherein the oil has disappeared from sight and touch and its presence can be determined only by chemical tests, and it cannot be separated from the concentrate by any mechanical means but only by the methods of chemical analysis.

The Froment description is not mentioned by defendant's expert. It was produced during defendant's London testimony (R., Picard, p. 156), but defendant elected not to have it explained by any of his witnesses. It is very fully explained by Dr. Liebmann (R., pp. 290–294), and summarized and contrasted with the disclosure of the Froment patents (R., pp. 293, 294). Dr. Liebmann summarizes the disclosure as follows :

> " 1. Ore de-slimed and mixed with water, one to three and a half per cent. of oil, and one to two per

cent. of calcium carbonate, agitated at a speed of 300 revolutions per minute for about ten minutes. Result of agitation ; oiled minerals with gangue at bottom.

" 2. Mixture of No. 1, whilst being agitated, emptied through intervening vessels into a vessel provided with a perforated leaden coil and a slowly acting rake for turning at a speed of 10 to 12 revolutions per minute the oiled minerals and gangue which had settled at the bottom of this vessel. Sulphuric acid introduced through the perforated leaden pipe and carbonic acid generated, resulting in oiled minerals attached to gas bubbles floating to the top by skin flotation assisted by carbonic acid gas bubbles" (R., p. 294).

Dr. Liebmann and Dr. Chandler also tested a reproduction of the Froment mixer and the Froment vat with coil in accordance with the directions, but found the apparatus inefficient. In the " vat with coil " the ore remained at the bottom in a compact mass notwithstanding the stirring device, and practically nothing came to the surface except a thin film of oil (R., Liebmann, pp. 320–321). Then they tested the process in more efficient agitating apparatus, to wit, a cone mixer or Gabbett, and a shallow separating vessel in which the ore was gently stirred by hand (R., p. 321, Expt. 2), and again in the modern slide machine, operating the agitator at the maximum speed of 1600 revolutions per minute and again using the shallow separating vessel and hand stirring (*idem*, Expt. 3). In each instance they stopped the agitation in the agitation vessel after the full period of agitation for the process of the patent in suit, and when the liquid came to rest there was no froth and no floating metal ; nothing but a film of oil on the surface of the liquid, with the oiled ore at the bottom. Then the agitation was resumed and the contents of the agitating vessel discharged into the separating vessel. In these experiments they obtained in the separation vessel a floating concentrate in the form of a magma or " a pasty mass of oil and minerals enclosing some carbonic acid bubbles " (*idem*). In conclusion, Dr. Liebmann says :

" In these experiments I went out of my way to give the Froment instructions the best chance of success, and, as is seen from the description of my experiments, I used apparatus in Experiment 3 which was not avail-

able at the date when the Froment instructions were received. These experiments confirm that the process revealed by the Froment instructions can be carried on in a laboratory for the concentration of ore, but is of no use for an economical concentration to-day, nor was it at the time when these instructions were received" (R., p. 322).

Dr. Chandler gives a brief explanation of the disclosure of the Froment description, and corroborates Dr. Liebmann's testimony as to the experiments, and says at the conclusion, both as to the Froment patents and the Froment description :

> "I cannot seriously consider these Froment disclosures as a disclosure of the process of the patent in suit. The process or processes are so substantially different in all essential particulars that they are not comparable" (R., p. 378).

The Froment patents and Froment description received very careful consideration in the decision of Judge BOURQUIN. They were, in fact, the principal reliance of the defendant in the argument before him. As Judge BOURQUIN says :

> "For anticipation, defendant relies most upon Froment's patents and working description" (R., p. 20).

Then follows a very careful summary of the disclosures, principally that of the description, and then Judge BOURQUIN compares all that Froment discloses with the process of the patent in suit as follows :

> "Detailed comment in respect to anticipation is little necessary save to Froment. Looking to the evidence and therefrom contrasting his process with complainants', Froment's requires several times the quantity of oil that does this in suit, both by examination of the patents and working description and by tests in evidence. Froment crushes the ore in two operations and de-slimes it before treatment because the slime is too fine to be treated by his process, while the process in suit needs but one crushing operation and finds slime advantageous and most easily recovered. Froment employs carbonate of lime; the process in suit does not. Froment *requires* acid and in greater quantity

and for a different function, than does the process in suit, which latter *may or may not* use acid. Both may use heat and both require agitation. Froment agitates only to disseminate the oil; the process in suit for that purpose and also to aerate. Froment's result is by flotation by gas generated *in situ*; this in suit is by flotation by air introduced by vigorous agitation. Froment's product is like unto a magma, a spongy pasty mass of oil and metallic particles and more or less of gas bubbles; while this in suit is a froth of oil and metallic particles and air bubbles. Froment's requires oil in such quantity that he deems it worthy of recovery from the concentrates, so far as it can be; this in suit so little oil it disappears, is not sensible to sight or touch upon the concentrates, but only to analysis. In Froment's it would seem that the metallic particles are floated like the basket of a balloon; while in this like the very envelope of a balloon. Froment's is costly, while this is cheap relatively. And from the evidence it would seem that Froment's process would fail in practical operation, while this in suit has succeeded. In Froment's, he oils the metallic particles by agitation, then, when the mixture is quiescent, generates gas therein by quick reaction, followed by immediate and direct rising of the gas bubbles to the surface, in which they may come into contact with but few metallic particles. In this in suit, vigorous agitation of the mixture beats great and excess volumes of air therein, likely bringing the ultimate air bubbles into repeated contact with many metallic particles. The action of the gas in Froment's is almost explosive in nature. He speaks of a proportion of carbonate of lime to be sought, as in his test-tube example the reaction may be so sudden and violent as to project the metallic particles out of the tube. Froment's gas bubbles, quick formed and quick rising, it may be, arrive at the surface with expansion still in progress. These or analogous reasons may account for Froment's magma, breaking gas bubbles and fragile evanescent froth in so far as his result is like unto froth, and also may account for the process in suit's strong and lasting froth" (R., pp. 21, 22; 207 Fed., 959, 960).

Then follows a description of the characteristics of the froth produced by the process in suit and the following statement:

"The differences hereinbefore set out between Froment's process and this in suit are so obvious,

numerous, radical and, in many respects, vital, it is clear they constitute different processes. They are different in ingredients, function of some thereof, combination, manipulation, principle and result. Their points of resemblance only serve to accentuate their difference" (R., p. 22).

Then follows the citation of nine leading cases of this Court wherein the law as to what constitutes a patentable process is set forth (R., pp. 22, 23), and the application of the law as thus stated to the case at bar. Again, returning to Froment, Judge BOURQUIN said:

> "To the contention that, as in Froment's process, the agitation must entrain some air like unto that of complainants', and so the latter lacks novelty, it may be observed that if so it was unintentional and unrecognized in that Froment had in mind only flotation by quick acting gas generated *in situ*, it aided the art none and is unimportant. (See Tilghman vs. Proctor, 102 U. S., 711).
>
> "And to the argument that in operating Froment, in rightful economy and decrease of oil, and in rightful omission of carbonate of lime in treating ore containing it in sufficient quantity, his process would approximate this in suit and arrive at a like froth and hence lack of novelty in the latter, the response is that the fact that infringement may be easy does not impeach an otherwise valid invention, and that if Froment's methods are modified until they approximate complainants' and so produce a like product, the process is no longer Froment's, but is complainants'" (R., pp. 23, 24).

Froment Process in Complainants' Laboratories.

Obviously this branch of the subject is wholly distinct from that of Froment's disclosures. It is the work of Messrs. Sulman, Picard and Ballot and their assistants in efforts to develop or produce something of utility out of Sulman and Picard's independent invention which preceded their knowledge of the Froment patents, and out of such knowledge as they acquired from the Froment British patent in August, 1903, and later, in December, 1903, and January, 1904, such knowledge as they may have acquired from the Froment de-

scription and experimental apparatus. This evidence does not bear upon anticipation, nor upon originality. They were seeking for something better than what they had, to wit, the Cattermole metal sinking process, and to this end were investigating all possibilities of metal flotation which occurred to them or which were communicated to them. As their reports show, they carried this investigation to such a point that on May 18, 1904, they were able to recover the metal from the tailings of the Cattermole process by skin flotation without the expense of limestone to be decomposed and sulphuric acid to decompose it, by the use of their table flotation process (*supra*, p. 64).

The scheme of their investigations was much broader than the Froment disclosures. They tried everything that they knew, over a period of about a year, which would tend to produce flotation of the metallic particles with quantities of oil such as they were using and deemed necessary, to wit: those of the Cattermole metal sinking process. What they did was unimportant and wholly unsuccessful, but defendant has brought it out at considerable length (R., Sulman, pp. 128, 129, 134, 135; Picard, pp. 149, 156, 157; Ballot, pp. 168, 169, 170; Higgins, pp. 176, 179, 180).

Mr. Sulman refers to the apparatus obtained from Mr. Froment and says:

> "Efforts were made to work this apparatus, but with no successful result" (R., p. 128).

Mr. Picard also refers to it and says that he did not himself test it because he was satisfied "that only indifferent results could be obtained by its use" (R., p. 156).

Mr. Higgins tested this apparatus which he particularly and accurately describes and says:

> "I do not remember performing any considerable number of experiments, as the results of the few I performed were hopeless" (R., p. 176).

Thereafter Mr. Chapman, for complainants, testified as to tests of this Froment apparatus, which he found to be "entirely unworkable" (R., p. 182), and to his determined effort to try and get the Froment process "to work in some

simple and practical manner" (R., p. 182), and describes an operation suitable only for the laboratory which he arrived at, as the only procedure whereby "the difficult Froment process can be made to give any resemblance to a practical separation" (R., p. 183). He describes the Froment apparatus received by Minerals Separation (R., p. 198) with a slight error, which he later corrects, identifying "Complainants' Exhibit Reproduction of Froment Mixer" and "Complainants' Exhibit Reproduction of Froment Vat with Coil" as an almost exact reproduction of this old Froment apparatus (R., pp. 387, 388); and it may be noted that this apparatus was reproduced by Mr. Higgins (R., p. 251) and is in exact accord with his description of the apparatus given when he was called as a witness for the defendant (R., p. 176). It may also be noted that the evidence clearly shows that the original Froment apparatus went to the junk heap where it belonged (R., Higgins, p. 176).

Schwarz Patents.

These patents, No. 807,501, of December 19, 1905 (printed R., pp. 663–666), application filed April 18, 1905, and No. 807,503, also of December 19, 1905 (printed R., pp. 667–670, *p. 1214), application filed May 27, 1904, are not prior patents. No. 807,501 was issued on an application filed seven days later than the filing of the British application corresponding to the application for the patent in suit. It is, therefore, too late, either as an application or a patent, and may be dismissed from consideration. It was not referred to in either of the decisions below.

The Schwarz patent No. 807,503, although too late as a patent, was issued upon an application filed May 27, 1904. The specification as filed was put in evidence in the trial court, but not included in the appeal record; but the patent may be taken as substantially identical with the application as originally filed.

The work of Schwarz was very nearly contemporaneous with that of the patentees of the patent in suit. He was plainly trying to improve upon the Elmore oil-buoyancy flotation process. To this he proposed to add the injection of

"air, steam or gas" so that the oil or selective material would take up an appreciable quantity of air or gas

> "giving a certain amount of sponginess, which increases its floating power" (R., p. 668).

Thus by producing air bubbles in a mass of oil he aimed to increase the flotative power of the oil, with the result, of course, that a smaller amount of oil would then float the metallic particles than if the process relied only upon the buoyancy of the oil. He does not, however, say that he effects any economy in oil, and his alleged improvements are described as principally relating to the addition of a material which is a solid fat at normal temperatures. This permitted the use of heat, which in the Elmore process was impracticable.

The specification first describes the Elmore process and Schwarz's alleged improvement above referred to (R., p. 667) and gives a specific example of Schwarz's selective material, viz.: "crude petroleum or any of its products, to which is added about nine to ten per cent., by weight, of paraffin" (R., p. 668), the latter being "a fatty matter which is solid at normal temperatures" (R., p. 667). The proportions of this mixture to be used are not described, but it is said that the dry ore

> "is mixed with sufficient of the selective material to make a thick pasty mass" (R., p. 668).

Water is then added and agitation continued until the water is distributed through this oily, pasty mass.

> "The mass is then allowed to subside, when the selective material, with the entrapped metallic constituents of the ore, will rise to the top and may be removed in any suitable manner, as by floating over the top of the vessel" (*idem*).

From this mass of oil, fat and metallic particles

> "the values may be separated from the selective material in any suitable or well known manner—as, for example, by a centrifugal drum or filter press" (*idem*).

This was the Elmore method of separating the oil from the concentrates. To this is only added the above mentioned

injection of a gaseous fluid into the pasty mass, so as to give a certain amount of sponginess to the oil and fat, which would be true if the mass were viscous enough to retain the bubbles; and apparently this is to accompany the addition of water to the pasty mass and may be continued after the water has been added

> "to assist in distributing the water throughout the mass and to effect a thorough separation and washing out of the tailings" (*idem*).

Apparatus is shown consisting of a mixing vessel 2, in which the dry ore is to be mixed with the oil and fat, a separating vessel 4, in which water is added and in which the metal is floated by the spongy mass of oil and fat, and here "if cold water is employed, the selective agent will be solidified" (R., p. 669) and we will have a floating, highly viscous and nearly solid mass of spongy fat with metal particles embedded in it; "a remelting and storage vessel 6," a "centrifugal drum 7" for separating part of the oil and fat from the metal, "a storage vessel 8" for the separated oil and fat, and a "pump 9" for raising the separated oil and fat to the mixing vessel 2.

This is the whole of the Schwarz disclosure.

Defendant's expert, Dr. Byrnes, without attempting to explain the language of the Schwarz specification, states certain erroneous conclusions as to the disclosure of the two Schwarz patents (R., pp. 101, 102), and describes an experiment, which he calls the carrying out of "the process of the Schwarz patents Nos. 807,501 and 807,503" (R., p. 106). In this experiment he employed not the described Schwarz mixture of oil and fat, but an oil not mentioned by Schwarz, cotton-seed oil, and carried it on not in the Schwarz apparatus, but in a modern slide machine, and his procedure was totally at variance with the Schwarz disclosure. In his summary of the Schwarz disclosure he says that it produces "a floating froth of concentrates" (R., p. 102), and then further says that the process includes "further aeration of the mixture by the injection of streams of air, steam or carbon dioxide gas, giving the froth sponginess and increased floating power" *(idem)*. Giving a froth sponginess is like gilding pure gold. The result of injecting gas into a froth can only

be to destroy it. What Schwarz clearly discloses is the injection of gas into a pasty mass of oil and ore. If the mass is viscous enough to hold the gas, this would make the mass spongy and give it increased floating power.

Dr. Byrnes, in describing his alleged Schwarz experiment, says that he used 3.6% of cottonseed oil, and mixed it with the dry ore

> "giving a homogeneous mass having the consistency of molding sand" *(idem.)*.

Molding sand is an almost dry sand. Schwarz says he produces "a thick pasty mass" (R., p. 668). Admittedly, therefore, Dr. Byrnes, for the purposes of this experiment, did not use an amount of oil such as would produce the "thick pasty mass" of ore and oil which Schwarz describes in the only part of his specification which gives any indication of oil economy as contrasted with the Elmore process. As Dr. Chandler testifies:

> "Dr. Byrnes described an alleged Schwarz test, but as he only used sufficient oil to give the mixture of oil and ore the consistency of molding sand, which is a slightly damp sand, it is quite certain that he did not follow the directions of Schwarz and did not produce a thick pasty mass of such consistency that it would acquire sponginess when air was blown in it" (R., p. 367).

Dr. Chandler then describes an effort to carry out a Schwarz experiment with Schwarz's specified oil and fat mixture in the proportion of 30 per cent. of the ore, which, although it produced a thick pasty mass of oil and ore, did not produce such a mass as would retain the air blown in it. Thereupon he performed another experiment, using oil in the proportion of 50 per cent. of the ore, and produced as the final result of his experiment a floating mass, mainly of oil with some air bubbles and considerable gangue in it, and tailings which sank and also contained considerable oil and metal particles. Thus he followed the directions of the Schwarz specification, and the fact that the procedure did not give successful ore concentration merely showed why this Schwarz process has never gone into

practical use. His procedure was only open to the criticism that he did not use Schwarz's special combination of apparatus, but, in place thereof, used the modern slide machine—a more efficient agitating apparatus and one unknown at the time of the Schwarz invention. But thereby he used the same apparatus as Dr. Byrnes had used and, for the information of the Court, gave to the real Schwarz process the greatest opportunity for demonstrating its resemblance to the process in suit.

Mr. Ballantyne has also investigated the Schwarz process as described in both of the Schwarz patents and found it quite useless. He testifies as follows:

> "The Schwarz process, described in United States patents Nos. 807,501 and 807,503, was brought to me by Mr. Schwarz some little time after the application for the patent in suit. His process closely resembles Haynes' process in that the powdered ore is first mixed with a mixture of oily matter and fatty matter, so as to make a thick, pasty mass, after which an attempt is made to wash the gangue out of the mass with water. I have tried processes of this type many times, and I know they are quite useless" (R., p. 224).

Dr. Liebmann also criticises the experiment of Dr. Byrnes and says that it had "no similarity whatever to the process described by Schwarz" (R., p. 277). He says that the result of the mixing of the dry ore with the altogether too small quantity of oil used by Dr. Byrnes, as described by Dr. Byrnes,

> "had the consistency of molding sand, *i. e.*, of an almost dry powder. The patent directs you that you are to have a thick, pasty mass" (R., p. 277).

Dr. Liebmann's full criticism of the Byrnes experiment (R., pp. 277–279), is summed up later and in this summary Dr. Liebmann says:

> "Schwarz makes first a paste of his ore and oil (the oil is a mixture of two different oils in certain quantities, which at ordinary temperature is solid) and then blows air or gas through pipes into this paste.

> To be able to do this he must at least use a quantity of 50 per cent. of oil, or 1,000 lbs. to the ton of ore; otherwise he could not blow the air in and keep the mixture of ore and oil in the vessel. Such a paste is pretty thick and he could only use slow agitation with it. He then mixes water with it and continues the blowing in through pipes of air or gas to assist in the distribution of the water throughout the paste and to effect the thorough washing out of the tailings. Schw recovery is due to oil buoyancy flotation assisted by the enclosure of air bubbles in the oil. Some of his oil is recovered by a centrifugal drum or filter press. The process is far too expensive to be of practical value" (R., p. 330).

Judge BOURQUIN does not mention this patent in his decision. It was not relied on by the defendant at the argument before him.

The Circuit Court of Appeals in its opinion says:

> "The Schwarz United States patent No. 807,503, applied for in May, 1904, and granted in December, 1905, describes a process in which the dry ore is first mixed with enough oil to make a *thick pasty mass*, and water is thereafter added, and the mass is agitated so as to cause the metallic particles to float. The quantity of oil to be used is not further specified, but it is in the testimony that the Schwarz process has been experimentally used with cottonseed oil, the quantity used being 3.6 per cent of the ore treated" (R., p. 717; italics ours).

This conclusion is contrary to the evidence. It was followed later by the statement as to all of the prior processes referred to, including Schwarz and the process of the patent in suit:

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth in all these processes is the same, with the exception that there is less oil (as there must necessarily be) in the appellees' froth than in the others. The froths are all similar in appearance, they all rise to the surface after the same amount of agitation, they all gather with

equal efficiency the same quantity of metal, and all may be removed from the surface in the same way" (R., pp. 720, 721).

This is also contrary to the evidence, not only as to the Schwarz patent (or more properly application, since the Schwarz patent was too late), but as to all prior disclosures, published and unpublished, referred to therein.

Further, in any event, the production by skilful manipulation of a floating mass of oil, air bubbles and metal with oil in the proportion of 3.6 per cent. is not a practical process of ore concentration (*infra*, pp. 198 *et seq.*) and is not the process of the patent in suit.

Kirby Patents.

These patents, No. 809,959, of January 16, 1906 (printed R., pp. 671–679, *pp. 1218–1220), application filed December 14, 1903, and No. 838,626, of December 18, 1906 (printed R., pp. 687–692, *pp. 1236, 1237), application filed December 17, 1903, are not prior patents, but the applications were filed early enough to evidence prior invention by Kirby had these applications disclosed the precise invention of the patent in suit.

These applications were put in evidence, but were not included in the appeal record, a rather unfortunate omission, since the record of the first filed application is illuminative as to the real character of the invention. Defendant had so little relied upon these patents in the argument before Judge Bourquin, that abbreviation of the record in this particular was deemed safe by complainants' counsel. Nevertheless, the invention is sufficiently disclosed in the patents as issued, and no point is made of the omission from the record of the best evidence as to what these applications disclosed when filed. The specifications of the belated patents may therefore be taken, for the purposes of this argument, as repeating the disclosures of the applications as filed.

The first filed application, for patent No. 809,959, discloses a process of the Elmore oil-buoyancy flotation type, with sub-

stitution of a thinner oily material, namely, a mixture of kerosene and bitumen or tar, in a proportion smaller than that used by Elmore. The specification says that to the pulp is added

> " a sufficient amount of the kerosene-bitumen solution, excellent results being obtained by using one-fourth to three-fourths as much, by weight, as ore " (R., p. 673).

The suggested proportion is from 500 to 1,500 lbs. of oil to the short ton of ore. The statement that the amount shall be " sufficient " can only be interpreted as indicating a sufficient amount to operate as Kirby very fully and clearly describes his operation, and tests by Dr. Liebmann with the minimum and maximum amounts suggested were found sufficient to produce the operations described by Kirby (R., p. 282).

The first filed application describes elaborate apparatus, fully illustrated (R., *pp. 1218–1220), and the second filed application is for one part of the apparatus, to wit, the separating tank, shown here with slight modifications (R., *pp. 1236, 1237). This application does not particularly describe the process, and says:

> " The invention is most useful when used to carry on one step of a process of my own invention, wherein the immiscible liquid employed is thin and light—as, for example, a solution of bitumen and kerosene, but the invention is also useful with oil processes for separating mineral particles " (R., p. 687).

The process of Kirby's own invention is clearly that of the first filed application, and the " oil processes " referred to are clearly the processes of the two Elmore patents, since the first filed Kirby application refers to them as " the prior processes which use thick, viscous oils " (R., p. 672) and it is said that these processes will " be aided by the addition " of Kirby's proposed injection of air or gas into the pulp, and it is further said that this will be useful,

> " because in spite of all the care which is exercised in the practice of those processes to keep the oil in large clots or masses, a great deal of it is ' floured ' or broken up into minute particles which are trapped in the sands

and lost. The employment of the gas in the manner stated brings in a more powerful floating agency than anything before used, which results in the recovery of this floured oil together with numerous coated particles which would not otherwise be floated " (R., p. 672).

This breaking up of the oil into small particles was a well known defect of the Elmore process and, as Mr. Chapman testifies relative to his work on that process :

> " It was our aim to avoid any breaking up of the oil " (R., p. 197).

A consideration of the details of Kirby's process and elaborate apparatus is laborious and quite unnecessary, and the details of Dr. Liebmann's explanation were omitted from the appeal record. (R., p. 279).

As stated by Dr. Liebmann, the process involves

> " the separation of minerals, partly by buoyancy flotation, partly by lifting the aggregates of minerals in oil by air bubbles. The quantities of oil which the inventor claims obtain excellent results are from 500 to 1500 lbs. of oil per short ton of ore. The oil is recovered by filtration and distillation" (*idem*).

The process of separation of the metal particles from the gangue is carried on in two tanks, a " mixing tank " A and a " separating tank " B (R., p. 674). The operation performed in the mixing tank is to " finely subdivide " the oil

> " into small globules and bring said globules into contact with substantially all of the pulverized mineral particles, which will, by preference, adhere to them " (R., p. 672).

This is a mixing and metal-oiling operation, and no other operation is ever performed in this mixing tank. The contents of the mixing tank are discharged into the separating tank and here the peculiar separating operations of the process occur, which are summarized in the specification as

> " allowing the hydrocarbon-coated (oil-coated) particles to float to the surface of the mass, and in rendering

this separation substantially complete by gently agitating the mass, and by injecting gas into the same, and preferably also discharging into the mass fine streams of the solution (oil)" (R., p. 672 ; parenthetical insertions ours).

The specification, in describing what takes place in the second or separation vessel, further says :

"Some of the hydrocarbon-coated particles will float to the surface without assistance" (R., p. 673).

This clearly describes flotation of some of the oil-coated metal particles by oil buoyancy. This is followed by the statement :

"but a considerable quantity of such particles will not be sufficiently buoyant, and some of such particles and some globules of the mixture (oil) would be trapped in the sands. In order to recover this less buoyant material together with the globules of the mixture (oil), the mass which tends to settle is slowly lifted and turned over to liberate the coated particles and the globules, and at the same time a gas, preferably air, is blown into the mass preferably near the bottom thereof" (*idem*; parenthetical insertions ours).

Thus we find that a considerable quantity of the oil-coated metal particles will not be sufficiently buoyant—are not sufficiently coated or mixed with oil—to float, and their flotation is to be assisted by air. We further find that some of these insufficiently buoyant oil-coated metal particles and some detached oil globules will be trapped in the sands, and that the gentle stirring of the sands and blowing in of air will result in air-assistance toward flotation of insufficiently-buoyant oiled metal particles, and their liberation from the sand, and the liberation from the sand of detached oil globules, which will, of course, be sufficiently buoyant to float when released from the sands.

Kirby not only injects air into the pulp in the separating tank but preferably also discharges therein

"fine streams of the solution" (R., p. 672).

By this oil addition in the separating tank the oil proportion is increased above the 500 to 1500 pounds per ton of ore originally added in the mixing tank. The rotating arms of the stirrer are provided with a number of oil jets or outlets 25 (five for each arm), and a number of air jets or nozzles 24, and an " inclined lifting plow 27 " (R., p. 675), and a number of " radially scraping blades 26, 26." The stirring arms of the mixing tank also contain the " lifting plows * * * and radial plows * * * just as in the separator tank " (R., pp. 675, 676). This stirrer of the mixing tank is said to be rotated " rapidly " by way of contrast to the stirrer of the separating tank, which is to be rotated " slowly ", but this is to be understood in a comparative sense and in the light of the knowledge of 1903, and with the Elmore gentle agitation as the standard of the art.

In describing the float produced in the separating tank, Kirby says :

> " The floating concentrates are carried mainly at the lower surface of the hydrocarbon layer, where it is in contact with the water " (R., p. 675).

This is characteristic of an oil-buoyancy float in which the metal particles tend to settle to the bottom of the floating oil layer, but is not at all characteristic of a floating froth wherein each bubble carries its own load of metal particles, and the bubbles pile up into an aggregation, frequently several inches high, and wherein there is no floating oil layer at all but simply air bubbles enclosed in water films loaded with metal particles.

It is to be expected that in Kirby's floating layer of oil, carrying metal particles, there will be bubbles of air, adding to the buoyancy of the float in the same manner that the air spaces in a cork add to the buoyancy of the cork, although the thinness of the oil employed rather militates against the retention of these bubbles in the floating layer of oil and metal particles. The floating material is gently pushed by the revolving " curved skimming bar 28 " (R., p. 675) into a " settling and washing chamber or box 29," and here some effort is made to settle the slimes, the upward air currents being deflected away from this box, and also to wash out the slimes by

" a stream of clean wash water introduced at the point 35 through the pipe shown."

It may be noted here that a modification is suggested which consists in doing away with the mixing tank A and performing both the mixing and the separation in the separating tank B, " which may then be termed the ' mixing and separating tank ' " (R., p. 676). When this is done, the agitating mechanism will be rotated " rapidly while mixing " and " slowly while separation is being made." This would make the operation intermittent, whereas it is continuous when the mixing and the separation take place in separate tanks.

" The material skimmed from the surface of the separating tank " (*idem*) is discharged into " the settling tank C " in order to get rid of the main bulk of water, " and thus reduces the bulk of liquid to be put through the " filtering operation." " The stream of skimming enters " (*idem*) the central cylinder of the settling tank " within which the water and hydrocarbon separate, the former sinking, while the latter, with its accompanying concentrates and air bubbles, floats in a layer as shown." Here again we have a layer of oil carrying the concentrates and containing air bubbles, and here again we have the characteristic of an oil-buoyancy float, viz. :

> " Most of the concentrates hang near the contact between the hydrocarbon and water, and as this contact surface becomes overloaded with concentrates some of them sink to the bottom of the tank " (*idem*).

Then follows filtration, preferably separately, of

> " the two streams, one of hydrocarbon and concentrates the other mainly of water and concentrates " (*idem*) ;

that is to say, a stream of oil and metal, without any water, is flowed into one of the filters and the oil separated from the metal by filtration, which the inventor says may in some instances be performed in " a simple open filter tank with a porous bottom of any of the well-known kinds, preferably light canvas " (R., p. 677).

The concentrates, from which all separation of oil possible in filters or filter press has been attained, are then discharged into a " retort furnace H " (R., p. 677) and the

oil is distilled off from the concentrates, condensed and used again. This is regarded by Kirby as an important feature of his invention. He says :

> " A distinct advantage of using a light hydrocarbon, like kerosene, is that so much of it as cannot be removed from the concentrate by mechanical means may be recovered by a process of distillation, this method of recovery being impossible when thick non-distillable oils are used " (R., p. 673).

The above is a fair description of the Kirby process, the principal feature of which is the employment of a thin oil in place of the thick oil which Elmore had to use. Had it been a workable process, it would have been an improvement on the Elmore process, but it was not and is not workable, and is merely another example of the failure of a nearly contemporaneous inventor to discover the process in suit.

The Kirby apparatus patent adds little to the disclosure of the process. It relates to the separating tank, but describes the process to some extent. For example, it says that, after the pulverized ore, water and oil have been thoroughly mixed in another tank and the charge has been flowed into this separating tank,

> " Most of the solution (oil) and the solution-coated (oil-coated) mineral particles rise immediately to the surface, from which they may be skimmed; but considerable quantities of the solution-coated (oil-coated) concentrates are enveloped by and entrapped in the sands which settle to the bottom of the tank " (R., p. 688; parenthetical insertions ours).

Then follows a description of the construction and operation of the complicated stirrer with its lifting plows and scraper blades and oil and air injection pipes, but here again we find a description illuminative of the Kirby process. It is said :

> " It is clear that some of these particles may be so large and heavy that the coating thereon may not be able to buoy them up " (R., p. 688).

The particles referred to are the oil-coated matallic particles, and the statement that they may be so large and heavy

that the oil-coating thereon may not be able to buoy them up makes it quite clear that oil buoyancy flotation was relied upon to float those particles which floated without assistance. Again the specification says:

> "The gas bubbles * * * tend to attach themselves to the solution-coated particles and to buoy them up after the fashion of balloons" (*idem*).

Here we have an exact explanation of what Kirby expected to happen. His oil-coated particles were so thickly coated that they were almost ready to float, and the gas bubbles were supposed to attach themselves to these heavily oil-coated particles and buoy them to the surface after the fashion of a balloon and its basket. In fact, there is a weak attraction between such an oil coating on a metal particle and an air bubble when the air bubble is immersed in a liquid, but that attraction disappears when the air bubble rises out of the liquid, as Messrs. Sulman and Picard found in their investigations (R., Picard, p. 153, Q. 68), so that the air bubble would sometimes assist the oil-coated metal particle to the surface, but usually then burst and left it there, dependent wholly upon self-support. In this instance the metallic particle was brought up into an oil layer, and sometimes the air bubble was held in the oil layer, and there was some flotation of metal, although the process was and is of no practical value.

Again in this specification we find that description which is an earmark of oil buoyancy:

> "The floating concentrates are carried mainly at the lower surface of the floating layer, where it is in contact with the water" (R., p. 690).

Dr. Byrnes makes no effort to explain the elaborate descriptions of these two Kirby patents, but devotes about half a page to summing up what he says these two patents show (R., p. 102). He suppresses the oil proportions suggested in the process patent and says as to the amount of oil disclosed in these patents:

> "2. The use of 'a sufficient amount' of the oil or oil solution to obtain 'excellent results' in the separation of the mineral by flotation" (*idem*).

The excellent results are said in the specification to be obtained by the use of the kerosene-bitumen solution in the proportion of

> " one-fourth to three-fourths as much, by weight, as ore " (R., p. 673).

Again he says that the type of agitator is a most efficient one " to produce a floating froth of concentrates " and evidently intended to say that such a floating froth of concentrates is produced, since he very generally and erroneously describes the subsequent operations as " the separation of the froth of concentrates from the tailings."

Thereafter he describes an operation of the modern slide machine, wherein he says he has " been able to carry out a process of separation corresponding to that of the Kirby patent No. 809,959 " (R., p. 105), and says that " without any injection of streams of air " to float the particles entangled in the tailings he produced a " floating froth of concentrates nearly half an inch thick." Then he says he roughly imitated the Kirby operation of blowing air into the tailings, but does not say that it had any effect. He further says that by removing the first froth and repeating the operation of aerating by agitation he " was able to remove so much of the zinc sulphide from the ore as to leave the tailings comparatively light in color, that is, consisting largely of gangue " (R., p. 106). This is all that he tells us of the result, and in the absence of assays it may well be concluded that even this miniature operation, not at all resembling Kirby, was a failure in the concentration of the ore.

Although Dr. Liebmann's full description of Kirby's process and apparatus has been eliminated from the record, his following brief statement appears and is a fair and accurate summary of the disclosure (R., p. 280). He criticizes Dr. Byrnes' erroneous statements and particularly Dr. Byrnes' alleged carrying out of the Kirby process. As to this, he says :

> " I say that Dr. Byrnes did not carry out Kirby's invention at all in this experiment and there is no similarity between Dr. Byrnes' process and the process and apparatus revealed in the two Kirby patents " (R., p. 281).

Dr. Liebmann then describes an experiment performed by him, not in the elaborate apparatus of the Kirby patents, since that was not available, but in the slide machine. This, of course, was only an approximation, but it produced "a layer of oil * * * on the surface of the water, which layer of oil enclosed minerals, some bubbles of air and some water" (R., p. 282). This was the float which Kirby describes in his specification.

> "The mass of gangue and pasty minerals which was at the bottom of the water was then gently agitated, and gas injected into it through a pipe. * * * The result of this operation was that the layer of oil and mineral which was on the surface of the water was disturbed in such a manner that most of the oiled minerals sank to the bottom of the apparatus, and only a very small part of it was left on the surface of the water mixed with very few air bubbles" (R., p. 282).

Then oil was added in a stream at the bottom of the vessel while the mixture was being gently agitated, as disclosed by Kirby, with the result "that oil was both on the surface of the water and at the bottom." The manipulations were repeated and carried on as carefully as possible, but only resulted in the recovery of 39 per cent. of the zinc contained in the ore. Dr. Liebmann's conclusion is:

> "The Kirby patents and the process revealed therein have nothing in common with the patent in suit and the process revealed therein. The Kirby patents and process rely on the separation of the minerals from ores by buoyancy flotation of the oil and mineral, assisted by the enclosure within the oil of air bubbles" (R., p. 282).

Dr. Liebmann's summary of these patents is as follows:

> "The two Kirby patents disclose an apparatus and a process for separating the minerals from the gangue by an oil buoyancy flotation assisted by air blown in through pipes at the bottom of the apparatus. This process is an improvement on Elmore, thin oils being used, which oils can be recovered from the concentrates completely by filtration and by distillation of the con-

centrates. The quantities of oil specified as giving excellent results are 500 to 1,500 lbs. of oil per ton of ore" (R., p. 333).

Dr. Chandler briefly explains the Kirby disclosures, particularly quoting the parts of the specification which clearly show that it is what it purports to be, an oil-buoyancy flotation process, employing a thin oil in somewhat smaller proportions than in the Elmore process, and with some assistance by air bubbles (R., pp. 300, 381). His conclusion is

> "The Kirby process is not the process of the patent in suit" (R., p. 380).

In cross-examination Dr. Chandler computes the oil buoyancy of the 25 per cent. of kerosene employed by Dr. Byrnes in his experiment alleged to represent Kirby, and finds that it was sufficient to float 43.2 grams of the 150 grams of metalliferous mineral in the ore treated, and that if Dr. Byrnes had used Kirby's maximum recommendation of 75 per cent. of the ore the oil buoyancy would have been sufficient to have floated 129.6 grams of the metalliferous mineral, leaving only 20.4 grams requiring assistance to bring them to the surface (R., pp. 384, 385, x-Q. 140). This shows what a large factor oil buoyancy is in the Kirby process, theoretically it is true, but the whole process is only a theory. As Mr. Ballantyne testifies

> "The process is of no use" (R., p. 224).

In the opinion of the Circuit Court of Appeals the Kirby process patent No. 809,959 is repeatedly referred to. It is stated that Kirby uses kerosene oil in which five per cent. of bitumen is dissolved, and then what is said to be a quotation of one of the claims is made (R., p. 717). This quotation is not, however, of any claim of the patents but is a part only of claim 6 of the Kirby process patent No. 809,959 and omits the concluding portion of that claim as follows :

> "in filtering the material so removed ; and in distilling the concentrate residue and condensing the hydrocarbon vapors driven off, substantially as specified" (R., p. 679).

This is the broad claim for the use of a peculiar and distillable oil and the recovery by filtration and distillation of this oil from the concentrate, and therefore omits the other features which characterize the Kirby process, to wit, the gentle agitation in the separating tank, the blowing in of air or gas to assist in the flotation of the oil-coated particles, and the flowing in of additional oil during the gentle agitation to assist in the flotation of the oil-coated particles, all of which are pointed out in other claims. Obviously although the claims of a patent which is relied upon for anticipation may be useful in assisting the court to understand the disclosure of the specification, it is to be expected that parts of the disclosure will be omitted from many of the claims, and they are therefore apt to be misleading as to the actual disclosure. Especially is this true when a fragment of a claim is taken to be the whole claim. They are statements of scope of invention rather than disclosures. The intent of claim 6, however, is that it shall be broad enough to cover the use of a distillable oil mixture (such as kerosene, having a proportion of tar or bitumen dissolved in it) in sufficient amount to ensure the coating of the metallic particles with the oil mixture and the entrainment of the metallic particles within the oil mixture and the production of a "floating layer" of the oil mixture containing the metallic particles, whether that floating oil layer carrying metallic particles shall have been produced in accordance with the Elmore procedure, by the utilization of oil buoyancy alone, or by Kirby's procedure wherein the oil buoyancy is assisted by bubbles of air. Obviously this claim, even in the part quoted, does not point out the invention of the process in suit. The process in suit certainly never produces "a floating layer of said solution (oil) and the mineral particles which have been coated thereby," in other words, an oil layer carrying metal particles.

The quotation of part of claim 6 is followed by a quotation from the specification describing agitation which will finely subdivide the oil into small globules and bring these small globules of oil into contact with all the metallic particles (R., p. 717), which exactly describes the character and kind of agitation employed by Kirby; and the following statement that the agitator is to be "rotated rapidly" is to be interpreted in the light of the object so clearly defined. Obviously

there is here no disclosure of an agitation which shall aerate the liquid. The statement in the opinion that "no specific quantity of oil is prescribed" is followed by its proper qualification, to wit, the suggestion of 25 per cent. to 75 per cent. of oil, and the words "a sufficient amount" are obviously intended to mean a sufficient amount for the Kirby process, and there is absolutely no evidence that the Kirby process is capable of being carried on with less than 25 per cent. of oil.

Again the Kirby patent is referred to as disclosing a procedure like that carried on in the process in suit in the mechanical steps employed (R., pp. 718, 719), but it will be noted that what is here described is equally applicable to the admittedly non-anticipative Elmore process, except that it is said that Kirby "violently" agitates; and here it is only to be noted that Kirby agitates with sufficient violence to attain the object which he seeks, viz., coating the metal particles with a large amount of oil.

Again the Kirby process is referred to and it is said

> "Kirby recommends thorough agitation by rapid rotation of the agitator, and he refers to the floating concentrate as a 'scum'" (R., p. 720).

As to the "rapid rotation" of the agitator, what has been heretofore said applies. As to the description of the floating concentrate as a "scum", this would be equally descriptive of the Elmore oil-buoyancy float, and is moreover associated in the Kirby specification with a further description which makes it quite clear that the "scum" referred to is a layer of oil which carries metal particles and contains some air bubbles. The description referred to in the decision of the Circuit Court of Appeals is as follows:

> "The floating scum of hydrocarbon liquid, air bubbles, and concentrates" (R., p. 675).

The further description a few lines further down is as follows:

> "The floating concentrates are carried mainly at the lower surface of the hydrocarbon layer, where it is in contact with the water" (*idem*).

This floating layer of hydrocarbon liquid or oil, with metal particles carried mainly in the lower part of the layer, is a characteristic oil-buoyancy float. A floating froth of air bubbles carrying metallic particles is a mass or aggregation of bubbles forming a layer frequently several inches thick, each bubble carrying its individual load of metallic particles. In the process in suit the oil coats the metallic particles with an invisible film and has disappeared from sight and touch. Obviously such a layer of metal-carrying air bubbles could not be described either as a floating layer of oil, or as a floating layer of oil containing metal particles "carried mainly at the lower surface" of the oil layer "where it is in contact with the water."

The other reference to the Kirby process in the opinion of the Circuit Court of Appeals is in the heretofore quoted statement as to all of the processes referred to as anticipative in the opinion, including Kirby, and as to the process in suit, that "the froth in all these processes is the same" excepting as to the amount of oil therein and that these froths

> "all rise to the surface after the same amount of agitation, they all gather with equal efficiency the same quantity of metal, and all may be removed from the surface in the same way" (R., p. 721).

The evidence fails utterly to substantiate this statement, and is quite to the contrary. The only experiment put forward by defendant as representing Kirby is lacking in the most important particular, viz., an analysis of the products obtained, which alone would justify a statement as to the efficiency of the result of this laboratory manipulation. Further the judgment of the practical art, which rejected the Kirby process, with the evidence of complainants' experts that the process is worthless, and the utter absence of any testimony in behalf of the defendant ascribing any practical value to the Kirby process, do not warrant the statement by the Circuit Court of Appeals that Kirby and the process in suit

> "gather with equal efficiency the same quantity of metal."

Defendant's miniature manipulation in the laboratory, even if it had been the Kirby process, and even if it had been efficient, would have demonstrated nothing as to the efficiency of the process in practical operations.

Wolf Patent.

This patent No. 787,814 of April 18, 1905 (printed R., pp. 511–514, * p. 992), was put in evidence by the complainants to show still another nearly contemporaneous effort to improve upon Elmore and utilize oil in the concentration of ores, and another well known agitating apparatus capable of being used in the process of the patent in suit in place of the cone mixer or Gabbett. The application date as it appears on the patent is May 22, 1903, but there is no proof as to what was disclosed in that application when filed. The patent was issued six months after the filing of the British application corresponding to the patent in suit, and is therefore not a prior patent, and defendant elected to make no proof as to the application filed in the secret archives of the Patent Office as a result of which this patent was granted.

This patent was shown to Mr. Sulman during his examination for defendant, and he was asked whether he had ever used the agitating or mixing apparatus B shown in this patent drawing (R., p. 140, Q. 122). He replied that he had seen it in operation

> "used in connection with an oil buoyancy process wherein thick viscous oils were used to entrap and buoy up mineral particles in the same general manner as the Elmore process" (*idem*).

He further testifies that he was consulted by Wolf as to the Wolf oil process (R., p. 143) and that the mixing apparatus shown in that patent is a type of mixing apparatus that was well known as the Johnson mixer at the time of the Wolf application in May, 1903, and was designed to produce much the same effect as the Gabbett or cone mixer (R., pp. 143, 144).

Later Mr. Chapman testifies to his work under the instructions of Messrs. Sulman and Picard in testing this Wolf or

Scammel process (R., p. 182) and briefly describes it (R., p. 198), and Mr. Ballantyne also testifies as to knowledge of this process and the fact that a vigorous effort was made by Messrs. Sulman and Picard to carry it into effect, but without success (R., p. 222). He also testifies that the agitator above referred to shown in this patent was a good substitute for the Gabbett, capable of "giving the same type of mixing and aeration as the Gabbett or cone mixer," although in the Wolf process, with a large body of oil, the results were "nugatory" (R., p. 227).

The Wolf patent is briefly described by Dr. Liebmann, in so far as it discloses an agitator which "works in substantially the same way as a cone mixer" (R., p. 333). The entire patent is explained by Dr. Chandler, who says as to the mixing apparatus:

> "This is evidently a very good mixing apparatus, and if operated at sufficiently high speed, would aerate the liquid. It was clearly not so operated in the Wolf process. After the publication of the patent in suit, a metallurgist might well use this Johnson mixer as a modification of the mixing and agitating apparatus disclosed in the patent in suit" (R., p. 362).

Summary as to Prior Documents.

Dr. Chandler, in his classification and summary of prior documents first gives a classified list (R., pp. 358, 359) and then treats the documents separately and briefly (R., pp. 359–381), and at the conclusion of each class makes general remarks. The Court will find within these pages a complete statement of everything that is essential in the prior disclosures. Dr. Chandler, at the conclusion of his consideration of processes of ore treatment with oil, calls attention to the fact that there are in this class twenty-three documents describing twenty-two inventions, each aiming to solve the problem of the economical and effective concentration of ores by the utilization of the preference of oil for the metallic particles. He says:

> "These inventions commence with Haynes in 1860. Then there is a gap of more than twenty-five years.

Then comes Everson in 1886, the efforts to utilize it in modified forms in 1889 and 1890, Robson in 1897, the Elmores in 1901, Froment in 1902, the Cattermole series commencing in 1903 (application for patent No. 777,273), the graphite group, Glogner, Good and Kendall, in 1903 and 1904, the Kirby applications in 1903, the first Schwarz application in 1904, the Sulman and Picard first efforts in 1904. The Wolf process in 1904 * * * may also be added to the list. This record of invention is a record of partial or complete failures. It is in evidence that Elmore was used to some extent and that Cattermole was used to a small extent, but both of these processes long ago disappeared from use. The amount of capital invested and lost in these unsuccessful inventions would, no doubt, make a stupendous figure. The human effort must have been very great.

"But the process of the patent in suit solves the problem. It is simple, it is economical, and it is efficient. It can be used in simple apparatus. The expense of operation is slight and the recoveries are large, yet none of these prior documents discloses it. The phenomenon of the agitation mineral froth was an unknown phenomenon until discovered by Messrs. Sulman, Picard and Ballot, and made known by them in the patent in suit, and in twenty-four corresponding patents taken out in Europe, Asia, Africa, Australia and the Americas" (R., p. 381).

Dr. Chandler, after this full consideration of the prior art, is asked as to the novelty of the invention disclosed in the patent in suit (R., p. 381, Q. 125). We quote from his answer as follows:

"The process of the patent in suit is a new process, not disclosed in any or all of the documents referred to by complainants or defendant as prior documents. It was to me a most surprising process. After studying all these prior documents, my surprise is not diminished that such a process is possible. There is nothing like it disclosed in the prior art and the failures of other inventors tended to discourage rather than to encourage the hope that the economical concentration of ores was capable of realization in a process utilizing the affinity of oil for metallic substances" (R., pp. 381, 382).

He then refers to the Cattermole granulation process as the nearest approach to the process of the patent in suit and

says "This was a simple and workable process, but it was the reverse of the flotation process" (R., p. 382) and "taught that the best way to concentrate an ore was to sink the metallic particles" (*idem*).

Then he refers to "the Froment principle of generating carbonic acid by the use of sulphuric acid and limestone and attempting to float the mineral by the generated gas" and "the Sulman and Picard idea of lifting the mineral to the surface by streams of air," but says that nothing of practical value came from either.

Then he refers to "the oil buoyancy processes of Schwarz and Kirby—efforts to assist buoyant action of the oil by blowing in air," and also to the Elmore oil-buoyancy flotation process and says "This briefly summarizes the prior art."

In conclusion he says :

> "I regard the process of the patent in suit as one of the most remarkable and surprising processes which has ever been brought to my attention, and the invention as one of the most important inventions in the metallurgical art, and I further regard it as an entirely novel process not disclosed in the prior art" (R., pp. 382, 383).

It is true that in behalf of the defendant Dr. Byrnes presents what he calls a summary of the prior art (R., pp. 109–112), and expresses the conclusion that there is no novelty in the process in suit, but he merely makes an incomplete and largely erroneous index of parts of the disclosures of the different prior documents, which would be of no value, even if it were accurate. Dr. Liebmann replies to this index classification point by point (R., pp. 322–325), and mentions "the difficulty present in the minds of certain people that they cannot put themselves back to and form a correct opinion of the knowledge of an earlier time," and that "they interpret always by the latest standard" (R., p. 325).

Dr. Liebmann also states, from the standpoint of a scientist and technician, his crystallized views as to what constitutes invention in the technical arts :

> "An invention is not anticipated because some of the steps have been used before it was made to produce

different results. If that were so, the progress of the world would be arrested and further inventions would be impossible " (R., p. 322).

Then he gives examples in the commercial arts of inventions which have created new arts by mere variance in the proportions of the materials used and says:

" The novelty depends on the process as a whole and on the novelty of the result produced, and it does not matter whether any of the steps or all of them had been used before for different purposes, and it does not matter whether some of them had been used in earlier attempts to achieve a similar object and had failed. That rather increases the value of the invention, because the former failures were a warning against renewed attempts " (R., p. 323).

Dr. Liebmann, after his full explanation of prior documents, gives a careful explanation of the disclosures of the patent in suit, with reference to his tests whereby he verified these disclosures (R., pp. 308-320), and says at the conclusion thereof:

" In my opinion, the process disclosed in the patent and set out in the claims is a fundamentally new process which involves a hitherto unknown phenomenon " (R., pp. 319, 320).

Dr. Liebmann, at the beginning of his deposition, states that he has devoted three months to the study of the defendant's evidence and the patents referred to therein, and says:

" I have formed the opinion that the invention now in controversy is an entirely novel, ingenious and unexpected process, which by its great simplicity fulfills the most ideal demands of ore concentration " (R., p. 252).

Further he says:

" The present invention differs essentially from all previous attempts. It is true that oil is one of the substances used, but it is used in such quantities which were never heard of, and it produces a result which was never obtained before " (*idem*).

He then gives a description of the characteristics of the froth, which has heretofore been quoted (*supra*, pp. 46, 47). He also says:

> "Further, a very striking difference between the previous processes and the process of the patent in suit is the difference between failure and success" (R., p. 253).

Impracticability of Metal Flotation With Quantities of Oil Less Than Elmore and Greater Than That of the Process in Suit.

With the use of oil proportions, between those of the Elmore oil-buoyancy flotation process (with its minimum of 100 per cent. of oil, or 2,000 pounds of oil to the short ton of ore and 2,240 pounds of oil to the long ton of ore), and the process of the patent in suit (with its minute oil proportions varying slightly for different ores and different oils, but never in practice greater than .18 per cent., or four pounds of oil to the long ton of ore and 3.6 pounds of oil to the short ton of ore, and averaging .1 per cent. or 2.24 pounds to the long ton of ore and 2 pounds to the short ton of ore) there is only one practical process of ore concentration and that is the Cattermole metal-sinking process. This is established by the history of the art of ore concentration as proved in the evidence, and by the careful consideration in the evidence of all prior documents.

It is proved that the admittedly novel minute oil proportions of the process in suit are critical proportions, invariable with a given oil and a given ore. The following testimony of Mr. Chapman, who installed and operated the process of the patent in suit in Australia, Finland, Sweden and Wales, as to this point, is uncontradicted:

> "110 Q. What has been your experience when, in using the agitation-froth process on a commercial scale, with a normal and proper consumption of one and a half pounds of oil per ton of ore, this procedure has been varied by increasing the oil feed to two and a half pounds per ton of ore?
>
> "A. The mineral froth being produced on the spitz

boxes loses at once some of its natural color and lustre and becomes dull in appearance. The quantity of froth being recovered on No. 1 box is considerably lessened. The froth on No. 2 spitz is slightly increased and the same with No. 3 box. The tailings on examination immediately show increased losses of sulphide mineral. These losses take the form of well oiled agglomerations.

"111 Q. And what has been your experience when the normal and proper feed of one and a half pounds of oil per ton of ore has been diminished to half a pound of oil per ton of ore?

"A. The froth being recovered immediately diminishes in quantity and the color shows the presence of slime gangue. The supporting liquor of the spitz box immediately changes in appearance and shows the natural color of the ore slimes. The tailings become very dirty and show no sign of what we know as a good 'clean up'. In fact the whole treatment suffers and unless the oil feed is restored to its normal condition a serious drop in recovery takes place with the production of a lower grade concentrate" (R., pp. 195, 196).

This evidence is not only uncontradicted, but corroborative of the evidence in behalf of the defendant of defendant's foreman, who, in describing the rules which governed his operation of defendant's infringing process, said:

> "Too much oil is indicated by a flat film on the surface of the water, the mineral forming globules and sinking. * * * When too little oil is used, there is no separation of the minerals and waste" (R., Gibson, p. 75).

As to the relation of the laboratory tests of the process in suit in the slide machine to the practical operations of the process in suit at the mill, it has always been found that the practical operations give a slight improvement over the procedure as carried on in the slide machine. This appears from the testimony of Mr. Chapman, who says that it has been a part of his work to carry out tests in the slide machine and describes his method of carrying on these tests (R., pp. 191, 192, Q. 51), and later says:

> "In my experience with the agitation froth process I have found on every occasion that has come under my own personal observation that the results of tests in the

slide machine were always improved in the actual working of commercial plants. The improvements were not only those of recovery, but in the consumption of reagents" (R., p. 195).

Obviously, if the slide machine laboratory tests were incapable of reproduction on a large scale, the procedure carried on in them would be worthless in the concentration of ores. Notwithstanding this obvious fact, however, the defendant has endeavored to prove by laboratory tests in the slide machine that it is possible to concentrate ores by metal flotation with the employment of such oil proportions as are disclosed in prior documents. Additionally it has been falsely represented that these laboratory operations carried on in the test machine of the process in suit (this test machine having been invented in 1909) and with the utilization of all the knowledge that has come to the art by reason of the process in suit, are representations of the disclosures of these prior documents, as is indeed necessary to give to these demonstrations any evidential value in behalf of the defendant; but as to this enough has been said in the chapters devoted to the respective prior documents.

In behalf of complainants, for the information of the Court, tests were carried out, first, in a miniature of a commercial plant, used for testing purposes, and, then, in a small commercial plant, and the procedures in the slide machine with the amounts of oil in excess of the critical proportions of the process in suit were found to be hopeless and useless in anything approaching practical operations.

The first of these tests was made by Mr. Higgins in a continuous testing plant of miniature size used for testing purposes and having a maximum capacity of seven tons per day, with the employment of cottonseed oil in the proportion of 3.6 per cent. of the ore (R., p. 387). The apparatus contained eight agitating vessels and six spitzkastens, and the successive agitations and flotations caused a recovery of only 50 per cent. of the zinc in the concentrates, *i. e.*, the process wasted half of the values in the ore. As to the floats obtained, Mr. Higgins says:

"These floats were exceedingly dense and occasionally fell down in large masses. The tailings contained some granules, and did not indicate a satisfactory recovery" (*idem*).

The original ore contained about 20 per cent. of zinc and the tailings about 13 per cent. of zinc, whereas in Dr. Byrnes alleged Froment slide machine test, with substantially the same ore and the same oil in the same proportion, the tailings had contained only one per cent. of zinc (R., p. 108) and the recovery was on his figures impossibly in excess of the amount of zinc in the ore (R., p. 299). In Dr. Byrnes practically identical alleged Schwarz test, the tailings only contained .7 per cent. of zinc (R., p. 106). Thus the procedure of Dr. Byrnes, with careful manipulation of the laboratory slide machine, was not duplicatable in even a small test with continuous apparatus.

Tests were also made by Mr. Chapman at London in the standard 50-ton plant with the only ore available there in sufficient quantity, Broken Hill tailings (R. p. 388), with cottonseed oil in the proportion of 3.6 per cent. of the ore and oleic acid in the proportion of 1.8 per cent. of the ore. These tests are fully described and the results as shown by analyses set forth (R., pp. 388–392). The amount of metal lost in the tailings in the three tests with 3.6 per cent. of cottonseed oil varied from 68 per cent. to 86 per cent.—an absolutely hopeless operation. The tailings contained granules and the granules from the tailings of test No. 2 are in evidence as "Complainants' Exhibit, Cattermole Granules Chapman London Test." Test No. 4, with 1.8 per cent. of oleic acid, was not so bad in loss of metal, which was about 30 per cent., but the concentrate contained so much gangue "that it would not really be considered a concentrate" (R., p. 795). This is shown by the large percentage of insolubles in the concentrate or by a comparison of the 18 per cent. of zinc in the original ore with an average of only about 22 per cent. of zinc in the concentrates, and of the 5 per cent. of lead in the original ore and an average of only 6 per cent. of lead in the concentrates.

The effect of these tests on the plant was to make the plant so dirty and greasy that it took a fortnight of cleaning to restore the plant to working condition (R., p. 393, Q. 254), whereas with the operations of the process in suit "the oil disappears. The dirt in the plant is never greasy" (R., p. 393, Q. 255). These tests made it quite clear that the laboratory operations carried on by Dr. Byrnes and alleged to represent processes of ore concentration, were wholly incapable of pro-

ducing any useful result in practice, and that the larger the plant the worse the result. Of course, the burden was on the defendant to show practical ore concentrating operations, to demonstrate that the verdict of practical men of the art in rejecting the procedures disclosed in prior documents was an erroneous verdict. Unable to prove practical use in the art of any of these paper processes, the defendant should at least have proved that they were capable of practical use. The failure of the defendant to prove any operation on a practical scale, obviously intentional, is submitted to be conclusive as against the practicability either of the actual disclosures of the prior documents or of what the defendant falsely represented them to be.

The Question of Invention.

Inventions are usually capable of being thought out. After they have been thought out comes the familiar contention that they were perfectly obvious from prior knowledge, as in the familiar illustration of Columbus and the egg. But the invention of the process in suit is not of that character. When discovered, it was as much of a surprise to the inventors, learned and skilled as they were in all the live knowledge of the art and in more than the art knew, as it was to the world at large when disclosed. Unwittingly they prepared the way, they assembled the factors, they directed the procedures which led to the discovery of the process, but wittingly they recognized and applied the process when discovered. They were investigating a metal-sinking process and diligently and intelligently searching for what they could find, and they found the metal-floating process in suit, simple, economical, efficient, inevitable in its operations, and, like Minerva from the brain of Jove, born full-grown and ready to do its work, but on principles of operation not only theretofore absolutely unknown but mystifying and inexplicable even to this day. It was, as Dr. Liebmann says, an

> "unexpected process, which by its great simplicity fulfills the most ideal demands of ore concentration" (R., p. 252).

And, as Dr. Chandler says,

> " one of the most remarkable and surprising processes which has ever been brought to my attention " (R., p. 382).

And this was said in the light of all the learning of the metallurgical arts as well as of the knowledge that has been dug up from obscurity by the defendant. As Dr. Chandler says :

> " After studying all these prior documents, my surprise is not diminished that such a process is possible " (R., p. 381).

The process of the patent in suit cannot be explained to-day. The invention is now more than eleven years old, yet world-wide publicity and scientific investigation have failed to produce an adequate and complete explanation of its operations. It is manifest therefore that it could not have been thought out beforehand. There was no knowledge from which it could have been reasoned out. Where explanation after the event is impossible, prevision was likewise impossible.

The Circuit Court of Appeals, however, expresses the opinion that, although the patentees " made a valuable contribution to the art in discovering the smallest quantity of oil which would produce the desired result," they only " pursued the course which all skilful metallurgists would be expected to pursue " and " their discovery that a small fraction of one per cent. of oil is sufficient to produce flotation of the metalliferous matter cannot * * * be made of itself or in a combination the subject of a patent," and concluded with the statement that the complainants " cannot take from others the right to use oil economically " (R., p. 723).

To this contention that the process of the patent in suit is mere economy of oil such as would have resulted from the investigations which any skilful metallurgist would be expected to pursue, the evidence is a complete reply. The historical facts as to the invention, and as to the investigations of other metallurgists, which failed to disclose or produce the invention in the whole period of forty-five years from the Haynes patent in 1860 to the invention of the process in suit in 1905, destroy any argument of non-invention based

upon what skilful metallurgists might have been expected to do.

The history of the art shows that the efforts of metallurgists, from Haynes in 1860 to the Elmores in 1901, succeeded in producing a workable metal-floating process only by using great quantities of oil, the workable Elmore process using the maximum amount of oil. The Elmore process reached the mill, it actually concentrated ores, but it used at least 2,000 lbs. of oil to the short ton of ore. Its success in reaching the mill greatly stimulated investigation as to oil processes of ore concentration, and so we have Froment in 1902, Cattermole in 1903, Kirby in 1903, Schwarz and Wolf in 1904, all except Wolf disclosing procedures involving some economy in oil over that required in the Elmore process. We also may include Froment's efforts to improve upon the disclosure of his patents, culminating in a likewise unworkable skin flotation process, wherein for a lean ore he proposed to use only one per cent. of oil, and the Cattermole, Sulman and Picard and the Sulman and Picard efforts to produce useful metal flotation with the Cattermole quantities of oil. Out of all these efforts, however, there came but one usable process, to wit, the Cattermole metal-sinking process. This record demonstrates that it was not within the skill of the expert and engineer to economize below the Elmore oil proportions in a practically usable metal flotation process. We may perhaps note the exception that Sulman, Picard and Ballot in their laboratories worked out a skin flotation process capable of being used at the tail end of the Cattermole process to float, by table flotation, some of the metal in the tailings of the Cattermole process, this being the final culmination of their efforts to improve upon their own ideas as to metal flotation and Froment's contribution disclosed to them in the latter part of 1903 by Froment in the Froment description.

A specific instance of a desperate effort to economize oil which occurred in Australia has heretofore been described (*supra*, pp. 64, 65). The Cattermole process was installed at great cost, but was found too expensive in oil consumption, and Mr. Chapman, armed with full knowledge of all of the work of Cattermole, Sulman, Picard and Ballot which preceded the invention of the process in suit, produced an application of skin flotation on tables, engrafted upon a spoiled

Cattermole operation, with a reduction of the oil consumption to .8 per cent. This was after the discovery of the process in suit, but in ignorance thereof. It would not have led toward the invention in suit, but away from it. This hybrid process was abandoned the moment knowledge of the process in suit reached Australia.

The testimony of Mr. Higgins, descriptive of the work in which he so largely participated in investigating the Cattermole process in the laboratory of the complainants prior to the discovery of the process in suit, exactly states the actual attitude of the most skilful metallurgists in this art in the world and what was to be expected of them in efforts in oil economy. Mr. Higgins was asked if he had experimented with different quantities of oil, and he replied :

> " A. Yes, there may have been different quantities, but whenever the granulation became imperfect by reason of the drop in the quantity of oil, the oil was naturally increased " (R., p. 176).

As to the finding by the Circuit Court of Appeals that the invention was merely a matter of degree—" a difference of degree and not of kind "—(R., p. 719), it is submitted that the evidence is conclusively to the contrary. As above noted, an increase in the quantity of oil above the critical proportions of the process in suit destroys the process. So also diminution in the quantity of oil destroys the process. The proper proportions are highly economical, but the process is as much dependent upon them as if they were prohibitively expensive. The economy of oil consumption is a highly meritorious feature of the invention, but the invention should not be condemned because of its merit in this particular.

The failures of the prior art were due to wrong principles and wrong modes of operation. Prior inventors failed because they did not discover the way to utilize the right principle and the right mode of operation. The fact that the principles and modes of operation of prior inventors required the use of large amounts of oil, with its attendant expense, merely evidences how strong indeed was the inducement for improvement in this respect; and prior inventors attacked this problem both directly and collaterally. Kirby suggested a minimum of 25% of oil (and his suggested minimum would, of course,

have been lower had it been possible with his process), and then disclosed refinements in the oil recovery, by both filtration and distillation, which enabled him to recover and reuse all of his oil. Certainly he did not fail because of the price of oil. Even Elmore effected a recovery and reuse of more than 90% of the oil which he used, and Cattermole provided for the recovery by chemical means and the reuse of all of his oil, by a method moreover which is applicable to the process in suit when oleic acid is used. Prior inventors either used oil in such proportions that the recovered concentrates were moistened by it, or abandoned the use of oil altogether, as did Bradford, and Everson in the later patents wherein she was joint inventor or part assignee, and Delprat and Potter. It was not conceived, nor was it from the knowledge of the art conceivable, that there was a condition wherein oil would be used and would be a determining factor of success, and would yet have disappeared from sight and touch—wherein air bubbles and apparently clean metallic surfaces would become so firmly attached together under the controlling action of extremely minute quantities of oil, that flotation of the heavier metal particles would be a reliable and dependable and inevitable result of agitation and aeration of an ore pulp. This process—the process of the patent in suit—eluded the mental grasp of all prior inventors—escaped their experimental investigations, and remained undiscovered until March, 1905—forty-five years after the attention of the metallurgical world had been directed to the selective action of oil for metal particles by the Haynes patent—and that patent an attempted application in the art of concentrating ores of knowledge published in the works of Herodotus in the fourth century B. C.

In prior efforts oil was the selective and separating agent and was an apparent factor throughout the procedure. The process in suit utilizes oil, it is true, but utilizes it as a bubble and froth controlling agent. The real flotative agent is air, functioning in the presence of a minute quantity of the oil or frothing agent, and the oil disappears from sight and touch, and does not prevent but to the contrary assists the firm attachment of the air bubbles and metallic particles.

The success of the process in suit, where all prior inventors failed, accompanied by recognition in the art of its status as a patentable invention, even to the limited extent that this suc-

cess and recognition appear in the evidence (which was closed more than four years ago) is truly phenomenal. It was put to work immediately and has been at work ever since in Australia, under license from the patentees, and part of its work there was the recovery of the valuable metals from the theretofore untreatable waste material of former processes, the great dumps of Broken Hill, Australia, eleven million tons of what was formerly waste material. It has recovered and is daily recovering valuable metals from the slimes which were formerly wasted, and it has reorganized the grinding of ores so that now the millman fearlessly grinds to such fineness as to assure the separation of all metallic particles from all gangue particles. The slimes that were the bane of the millman are now advantageous, and their presence assists the recovery.

The process in suit has largely replaced the standard metal concentration process of the art (the water concentration metal sinking process), and has wholly replaced the other metal sinking process of the art, the Cattermole oil granulation process. The evidence shows the recovery of valuable metals in the value of at least ten million dollars by the process in suit under license from the patentees. What has been done since the evidence closed is a matter of common knowledge. It may be said *dehors* the record that in this country twenty-five million tons of ore are annually treated by the process in suit, and that notwithstanding the decision of the Ninth Circuit Court of Appeals holding the patent to be void, and rendered May 4, 1914, considerably more than half of this treatment is under license from the patentees.

The authorities bearing upon the question of invention will be considered in the appropriate headings in the following part of this brief devoted to points of law.

Hyde Patent.

This patent No. 1,022,085 (printed R., pp. 698–705; * p. 1250) is defendant's patent. The application was filed November 10, 1911, about a month after the commencement of this suit by the filing of the bill of complaint on October 9, 1911, and was diligently prosecuted, so that the patent issued

about the time of the commencement of the testimony, and was put in evidence by the defendant. Thus it was a document prepared contemporaneously with the answer, and moreover it contains the signatures of defendant's counsel in this suit, and its object undoubtedly was to create the impression that the defendant was an independent improver upon the prior art. It is in fact a void patent disclosing not a shred of novelty or invention, but even if it were a valid patent, it could not excuse the infringement. Its subject-matter is best explained by the defendant himself in his ingenious statement of the mental processes whereby he evolved the two alleged inventive ideas which constitute the whole of the invention claimed (R., pp. 85, 86). He says that his concentrates first obtained were not of as high a grade as he had expected, containing considerable gangue, and that

> "The thought occurred to me that if the froth which was first formed was retreated by itself, it would be possible to disentangle and drop out a considerable portion of this worthless material" (R., p. 85).

This is the first point of his patent, retreatment of the concentrates.

But this was the established practice of the complainants at the time the defendant entered their employment, and it was then disclosed to him.

The other point of the patent is the use of sulphuric acid as a pulp thickener, to settle the slimes in the pulp before the pulp is put through the process of the patent in suit. As to this defendant says:

> "The thought occurred to me that sulphuric acid might advantageously be made to act as a co-agulant of the slimes in the pulp-thickener" (R., p. 86).

But this was common knowledge of the prior art, as well as of the staff of the complainants when the defendant was part of that staff, and is described in the leading text book of the prior art "Richards' Ore Dressing."

Retreatment. An apparatus for the retreatment of concentrates was operated in the London works of the complainants when the defendant was there, in December, 1910 (R., How-

ard, pp. 209, 210). This plant is shown in the drawings of complainants' British patent No. 23,949 of 1910 (R., * p. 1044, facing page 556). That this plant was frequently operated in the presence of defendant is admitted by him (R., pp. 84, 85, Q. 40; pp. 95, 96), and its principles were fully discussed with the defendant (R., Howard, p. 210), and were further explained in a report of Mr. Nutter, dated December 3, 1910 (printed R., pp. 461–463), which was given to the defendant (R., Ballot, p. 169, Re-d. Q. 137).

Retreatment of concentrates was part of the ordinary practice in Australia during the early days of the use there of the process in suit (R., Chapman, p. 196). It had been accepted as standard treatment in the London works as early as 1909 (R., Howard, p. 210). It was actually applied to one of the ores brought to London by the defendant (R., Howard, p. 209), as appears in a report of Mr. Higgins of January 4, 1911 (printed R., p. 405).

Retreatment of concentrates is also repeatedly referred to in the complainants' British patent No. 23,870 of 1910 (printed R., pp. 542–548), as well as the other British patent above referred to, 23,949 of 1910.

Moreover retreatment is merely doing the same thing over again, and is not invention (R., Liebmann, pp. 335, 336, Q. 51; Ballantyne, p. 230, Q. 33).

Slime Settlement by Sulphuric Acid. The use of sulphuric acid for this specific purpose is repeatedly referred to in the standard text book of the prior art, "Richards Ore Dressing" (extract printed R., pp. 467, 468), published in 1905 (see Stipulation, R., p. 340).

Dr. Liebmann explains this patent of the defendant (R., pp. 337–340, Q. 56) and says:

> "This patent contains a description of the process disclosed in the patent in suit" (R., p. 337).

Judge BOURQUIN considered this patent as corroborative on the question of infringement, as it undoubtedly is, notwithstanding the effort throughout the patent to disguise the fact that it discloses the process of the patent in suit.

Law.

I. *Issue of Patent is Presumptive Evidence of Patentability.*

This point has been so well established by the decisions of this Court that a reference to the leading decisions will be sufficient.

Lehnbeuter v. Holthaus, 105 U. S., 94, 96.
Gandy v. Main Belting Co., 143 U. S., 587, 595.
Westinghouse Co. v. Wagner, 225 U. S., 616.

A full statement as to this point and its reasonableness appears in a late decision of the Circuit Court of Appeals of the Seventh Circuit, *Railroad Supply Co. v. Hart Steel Co.*, 222 Fed., 261, 274, Judges BAKER and SEAMAN, C. Js., and GIEGER, D. J.; opinion by BAKER, C. J. The following is an excerpt from that decision:

> "Another consideration is the presumptive validity of a patent. From long and continued repetition of the phrase the members of the patent bar and of the patent bench sometimes may seem to get into the condition of the man who repeats a word over and over until it fails to convey any meaning to his mind. But this presumption should be given more than formal recognition. A 'patent' is a contract between the government on behalf of the people and the patentee. The grant of a patent might have been made conclusive evidence of its validity except against suits by the government for fraud or mutual mistake in the issuance. But the fact that certain defenses are left open to the individual should not make us lose sight of the nature of the presumption that attaches to the grant. Not merely has the application been examined on behalf of all the people by experts who have access to all the prior patents and publications of the world; not only has the applicant spent his time and invested his money in procuring the patent; but in most of the important cases the patentee and those working under him have invested very large sums in buildings and machinery and have expended other large sums and put in great energy and effort to build up, by advertising and salesmanship, a profitable business. And this is done before any one challenges the presumptive validity of the

patent. Courts therefore should not view the application as of the date of its filing and constitute themselves into a board of reviewing examiners and on nicely balanced considerations find that the Patent Office Examiners were in error; but they should consider the patentee's equities in his business which has developed under the presumptive validity of the patent, should give heed to the place achieved by the patented article in the field of the practical art since the date of the patent, and should therefore decline to sustain the defense of non-invention and to strike down the patent and the business built upon it unless that defense has been established beyond a reasonable doubt. In this case we find that the appellees have not so maintained their defense" (222 Fed., 274).

II. *Patents are to receive liberal treatment under a fair application of the rule, ut res magis valeat quam pereat.*

Turrill v. R. R. Co., 68 U. S., 491, 510:

"Patents for inventions are not to be treated as mere monopolies, and, therefore, odious in the eyes of the law; but they are to receive a liberal construction, and under the fair application of the rule, *ut res magis valeat quam pereat*, are, if practicable, to be so interpreted as to uphold, and not to destroy, the right of the inventor."

Rubber Co. v. Goodyear, 76 U. S., 788, 795:

"But liberality rather than strictness should prevail where the fate of the patent is involved, and the question to be decided is whether the inventor shall hold or lose the fruits of his genius and his labors."

McClain v. Ortmayer, 141 U. S., 419, 425:

"It is true that in a case of doubt, where the claim is fairly susceptible of two constructions, that one will be adopted which will preserve to the patentee his actual invention."

See also

Topliff v. Topliff, 145 U. S., 171.

Lamson Cash Ry. Co. v. Keplinger, 45 Fed., 245, 248, 249, JACKSON, J., C. C., Ohio, 1890.

In the latter case Judge JACKSON said :

> "If the question was even more doubtful than it is, still the Court should resolve such doubt in favor of the complainant, under the principle that a patent will not receive a construction which would render it invalid when it is susceptible of a different one consistent with its validity."

III. *Alleged prior disclosures must be clear and certain.* *Seymour v. Osborne*, 78 U. S., 11 Wall., 516, 555. Here Mr. Justice CLIFFORD, speaking of the disclosures of prior patents, said :

> "Mere vague and general representations will not support such a defense, as the knowledge supposed to be derived from the publication must be sufficient to enable those skilled in the art or science to understand the nature and operation of the invention, and to carry it into practical use. Whatever may be the particular circumstances under which the publication takes place, the account published, to be of any effect to support such a defense, must be an account of *a complete and operative invention capable of being put into practical operation*" (italics ours).

Cohn v. U. S. Corset Co., 93 U. S., 366, 370.

In the last entitled case, Mr. Justice STRONG said :

> "It must be admitted that, unless the earlier printed and published description does exhibit the later patented invention in such a full and intelligible manner as to enable persons skilled in the art to which the invention is related to comprehend it without assistance from the patent, or to make it, or repeat the process claimed, it is insufficient to invalidate the patent."

This rule was affirmed in *Downton v. Yeager Milling Company*, 108 U. S., 466, 471.

The courts have criticized foreign patents, and particularly British patents, by reason of the quite frequent lack of definiteness in their disclosures. *Westinghouse Air Brake Co. v. Great Northern Ry. Co.*, 88 Fed., 258, 263 ; C. C. A., 2nd Circ., WALLACE and SHIPMAN, C. Js. ; opinion by Judge SHIPMAN :

> "The prophetical suggestions in English patents of what can be done, when no one has ever tested by

actual and hard experience and under the stress of competition the truth of these suggestions, or the practical difficulties in the way of their accomplishment, or even whether the suggestions are feasible, do not carry conviction of the truth of these frequent and vague statements."

See also,

Warren Bros. Co. v. City of Owosso, 166 Fed., 309, 318, C. C. A., 6th Circuit; LURTON and SEVERENS, C. Js. and COCHRAN, D. J., opinion by LURTON, C. J.

Dayton Engineering Laboratories Co. v. Bowman Automobile Co., 229 Fed., 719, 722, C. C. A. 2nd Circuit, LACOMBE, WARD and ROGERS, C. Js., opinion by Judge LACOMBE. In the last cited case Judge LACOMBE says at page 722 of the disclosures of a prior British patent:

> " His patent is another instance of the ' prophetical suggestions ' found in many English patents which have been held not to bar the field to inventors who by time, thought, and experiment devise means to fulfill the prophecy."

In the Froment patents in the case at bar the disclosure is at most mere " prophetical suggestion," although the prophecies are unfulfilled.

IV. *Prior art processes should be considered and weighed only in the light of the knowledge of their own day.*

The Privy Council case, printed in the present record (*Ore Concentration Co., 1905, Ltd., v. Sulphide Corporation, Ltd.*, 31 R. P. C., 206), well states the law of England, at R., p. 750:

> " It is a general canon of construction, applicable to all documents, that the document should be construed as if the Court had to construe it as of the date of publication to the exclusion of information subsequently discovered. In patent cases the observance of this canon of construction has great importance. It is common, in such cases, to have a number of documents placed in evidence extending over a considerable period of time, each of which is relied on as disclosing relevant information prior to the date of the patent. If these documents require the assistance of experts to aid the Court in construction, the Court is deprived of the bene-

> fit of such assistance if the witness is asked to read the document not in reference to what was known at the date of publication, but to knowledge only acquired at some subsequent date."

Hanifen v. Godshalk, 84 Fed., 649, 652, 653, C. C. A., 3rd Circuit, SHIRAS and ACHESON, C. Js., BURTON, D. J., opinion by Judge ACHESON. Here defendant's experts testified that a prior patent to Booth disclosed the Bywater fabric of the patent in suit, and that by following the directions of the Booth patent they produced the fabric of the patent in suit. The lower court held the patent invalid. The Court of Appeals reversed this decision and said, as to the testimony of these witnesses for the defendant:

> "Testifying in 1896, it was impossible for these witnesses to divest their minds of their then knowledge respecting the Bywater fabric, and the mode of its production, even if they had been unbiased. But what a willing witness in 1896 might read into the Booth patent is no fair test. The true question is, what did this patent disclose to the public in 1881? We are well satisfied that the expert testimony of the defendants' witnesses furnishes no safe aid in the solution of that question."

Naylor v. Alsop Process Company, 168 Fed., 911, 920, C. C. A., 8th Circuit, SANBORN and VANDEVANTER, C. Js., and AMIDON, D. J., opinion by AMIDON, D. J. This case was referred to in the decision of the Circuit Court of Appeals in the case at bar and fairly summarized (R., p. 722). The error was in its application to the facts as established by the evidence in the case at bar.

Judge AMIDON said:

> "When it is sought to ascertain the state of the art by means of prior patents, nothing can be used except what is disclosed on the face of those patents. Such patents cannot be reconstructed in the light of the invention in suit, and then used as a part of the prior art."

Judge AMIDON then referred to a patent of the prior art which admittedly on its face did not disclose the process in

suit, and to the evidence in behalf of the defendant to the effect that by tests they had found that the process disclosed actually produced a material not mentioned on the face of the patent and said :

> " Prior patents are a part of the prior art only by what they disclose upon their face. If they are carried into effect in the industrial world, what is learned from that experience also becomes a part of the prior art. An expert, however, cannot take a process patent, which has never been applied industrially, and work the process in his laboratory, and discover therefrom something which is not disclosed on the face of the patent, and then transfer that experience back to the time of the patent, and make it a part of the prior art for the purpose of defeating a meritorious invention. That would be *ex post facto* law of the most pernicious character."

In distinguishing this case from the case at bar, the Circuit Court of Appeals for the 9th Circuit called attention to the fact that in this cited case the patentee had discovered a new agent which accomplished a new result. But it is even more conspicuously true in the case at bar that the patentees discovered a new agent—the air bubble—which, in combination with oil in unheard of minute proportions (and in such proportions performing a new function), accomplished a new and revolutionary result—the concentration of metalliferous mineral in a practicable and useful and economical manner, characterized by a metal-bearing floating froth. Aside altogether, however, from any parallelism as to the two cases, the doctrine of law of the cited case excludes from consideration all of defendant's experiments alleged to represent the disclosures of prior inventors, but in fact misrepresenting them.

Railroad Supply Co. v. Hart Steel Co. (*supra*), 222 Fed., 261, 273, C. C. A., 7th Circuit, BAKER and SEAMAN, C. Js., and GEIGER, D. J., opinion by Judge BAKER :

> " So far as human minds are able, judges should exclude from view the disclosure of the patentee, should regard the patentee's problem as of a time antedating the application, and should therefore not too readily accept the *ex post facto* wisdom of the bystander. Prior art structures are to be examined in view of the pur-

poses and laws of such structures. It is not enough that a prior art device approach very near the idea of the patent in suit; it must so clearly disclose the idea that it would be apparent to a mechanic of ordinary intelligence who was not examining the device for the purpose of discovering in it the idea of the patent. For, if he already had that idea, he would not be getting it from the prior art device, but from his own imagination or some other source."

Goodwin Film & Camera Co. v. Eastman Kodak Co., 213 Fed., 231, 238, C. C. A., 2nd Circuit, LACOMBE, COXE and WARD, C. Js., opinion by Judge COXE. Here the subject matter in issue was a process of producing photographic films. The finding of the Court is well summed up in the following language at page 238:

> "Our decision may be briefly stated—believing as we do, that Goodwin was the first to produce a transparent sensitive pellicle for use in roller cameras, the conclusion naturally follows that his patent is entitled to a liberal construction. Doubts should be resolved in its favor and care taken not to confuse the art at the date of issue with the art as it existed at the date of the application, eleven years before. So considered and construed, we think the claims in controversy valid and infringed."

Tannage Patent Co. v. Donallan, 93 Fed., 811 (C. C., D. Mass.), COLT, C. J. Here an effort was made to prove anticipation of the Schultz process for tanning hides by evidence of defendant's experts that the process disclosed in a prior patent of Francillon as a dyeing process was in fact a tanning process. Judge COLT said (pp. 820, 821):

> "With the Schultz process before him, it may be possible for a skilled expert to tan a skin by following what he believes to be a liberal construction of the Francillon specification, but that is not the question. Francillon is not to be interpreted in the light of and with the knowledge of the Schultz process. The question is assuming the Schultz process did not exist, does Francillon disclose a tanning process, and by following literally his instructions have you solved the problem of a practical and commercial method of chrome tanning? We think the question must be answered in the negative."

Again, Judge COLT says as to the weight to be attached to experimental operations as evidence of practically useful procedures (p. 815):

> "A process carefully conducted by a skilled expert may be adequate to tan skins, and yet be commercially perfectly worthless. Such experimental success should have little or no weight in determining the question of the validity or scope of the Schultz patent."

In the case at bar, the operations alleged to represent the disclosures of the prior art (but in fact misrepresenting them), were not only skilfully conducted by biased experts, but were operations in miniature. The defendant refrained from proving any normal scale operations alleged to represent the prior art. Complainants' tests of these operations under practical conditions demonstrated that they were worthless.

Schmertz Wire Glass Co. v. Western Glass Co., 178 Fed., 977, C. C., N. D. Ill., SANBORN, D. J. Here the patent was for a process of making wire glass, and the Court gave consideration to alleged anticipation by a British patent to Hyatt. The Court says as to this defense (p. 988):

> "This was most thoroughly presented on the argument and is made much of in the briefs and testimony, but does not seem to have been given much attention by the courts, which have heretofore upheld the Schmertz inventions. As already stated, this specification was never put into actual practice. Before attempting to construe it, to see whether it was capable of operation, the legal rule governing the case may profitably be examined to determine whether the Hyatt specification shows definite means of making wire glass. It may not be difficult, in the present state of the art, to read the Schmertz invention into the Hyatt disclosure; but could it have been done in 1874? No one ever succeeded in doing it, and this is some evidence at least that the description was defective. Was the original conception that of Hyatt or of Schmertz? By using twentieth century magnifying glasses a nineteenth century method has been found efficient which never was so before, and the immensely important point of view of an advanced art is thus unfairly used to discover an original conception never acted on or made anything of, and which never had any practical or beneficial existence."

This is followed by a review of the decisions, principally those of this court, bearing upon this question. Then the prior disclosure and the process in suit are compared, and the Court says (p. 990):

> "The case is brought within the rule, above stated, that the earlier process must be complete and operative in order to anticipate; and that, in case of doubt, complete success in the patent process, as against complete failure or non-user of the other, should turn the scale in favor of patentability and non-anticipation."

V. *Prior efforts and gropings of others to reach the end, if unsuccessful, are evidence of invention in that which does reach the end.*

Carnegie Steel Co. v. Cambria Iron Co., 185 U. S., 403. This case was cited by Judge BOURQUIN in his opinion in the case at bar (R., p. 23) as the Steel Company case, in his summary of the cases of this Court stating the law which he applied in finding that the invention of the process in suit was patentable. The opinion was by Mr. Justice BROWN, and well expresses the attitude of this court where an effort is made to destroy a successful invention by magnification of the prior gropings of other inventors which failed. The Jones patent here involved was for a process of mixing molten pig iron so as to secure greater uniformity in chemical composition and so as to avoid the necessity of remelting before further treatment in converters. The dominant idea was the permanent retention in a large covered reservoir of so large a quantity of the molten metal as would absorb or average the variations of the product received into it from time to time and discharged from it. This was held to be not anticipated by prior patents and publications which contemplated the storage or mixture in reservoirs of molten metal from blast furnaces for use in casting or in converters, in none of which was the retention of a notable quantity of the molten metal recognized as essential; or by the practice in steel works of mixing remelted pig iron from cupola furnaces in reservoir ladles in which a considerable residue was generally maintained. In the opinion Mr. Justice BROWN said (p. 429):

> "It is true that the Jones patent is a simple one, and in the light of present experience it seems strange

that none of the expert steel makers, who approached so near the consummation of their desires, should have failed to take the final step which was needed to convert their experiments into an assured success. This, however, is but the common history of important inventions, the simplicity of which seems to the ordinary observer to preclude the possibility of their involving an exercise of the inventive faculty."

Again, Mr. Justice BROWN says (p. 446):

"The surprise is that the manufacturers of steel, having felt the want for so many years, should never have discovered from the multiplicity of patents and of processes introduced into this suit, and well known to the manufacturers of steel, that it was but a step from what they already knew to that which they had spent years in endeavoring to find out. It only remains now for the wisdom which comes after the fact to teach us that Jones discovered nothing, invented nothing, accomplished nothing."

Then follows a quotation from the opinion of Mr. Justice BRADLEY in *Webster Loom Co. v. Higgins*, 105 U. S., 580, 591:

"But it is plain, from the evidence and from the very fact that it was not sooner adopted and used, that it did not, for years, occur in this light to even the most skilful persons. It may have been under their very eyes, they may almost be said to have stumbled over it; but they certainly failed to see it, to estimate its value, and to bring it into notice. * * * Now that it has succeeded, it may seem very plain to any one that he could have done it as well. This is often the case with inventions of the greatest merit. It may be laid down as a general rule, though perhaps not an invariable one, that if a new combination and arrangement of known elements produced a new and beneficial result, never attained before, it is evidence of invention."

Thomson-Houston Electric Co. v. Lorain Steel Co., 117 Fed., 249, 253, C. C. A., 2nd Circuit, WALLACE and TOWNSEND, C. Js., opinion by Judge TOWNSEND:

"Where, of a number of independent inventors working in the same field, one takes the last step which accomplishes the result sought, a strong presumption of invention is raised in his favor."

Binns v. Zucker Co., 70 Fed., 711, 713, C. C., S. D., N. Y., TOWNSEND, J. Here Judge TOWNSEND says :

> " The fact that these two persons, skilled in the art, having presented to them these same problems, failed successfully to solve them, is persuasive evidence that the patented device involved invention."

Mallory Mfg. Co. v. Marks, 11 Fed., 887, 890, C. C., S. D., N. Y., BLATCHFORD, J. Here Judge BLATCHFORD said :

> " With all the knowledge which skilled men had as to the twisting and set of resilient wire, they groped about, trying all methods but the one which was the needed one to secure the desirable result. Yet in this case as in all other cases like it, it is said that the means were so obvious as not to amount to invention."

In the case at bar, no question of obviousness can properly arise. The process in suit is not explainable even now, long after the event. How could it then have been predictable or obvious before the event? Where explanation fails, prevision must have been impossible, and the argument of obviousness falls. On the other hand, the failure of all prior inventors to reach the end in view may well be taken as evidence of invention in the process in suit.

VI. *The fact that new combinations or proportions of old ingredients produce a new result of high utility is evidence of invention.*

Diamond Rubber Co. v. Consolidated Co., 220 U. S., 428. The patent here involved was for a rubber tire for vehicles. Mr. Justice MCKENNA said of the patented tire (pp. 434, 435) :

> " The tire has utility, a utility that has secured an almost universal acceptance and employment of it, as will subsequently appear. It was certainly not an exact repetition of the prior art. It attained an end not attained by anything in the prior art, and has been accepted as the termination of the struggle for a completely successful tire. It possesses such amount of change from the prior art as to have received the approval of the Patent Office, and is entitled to the presumption of invention which attaches to a patent.

> Its simplicity should not blind us as to its character. Many things, and the patent law abounds in illustrations, seem obvious after they have been done, and 'in the light of the accomplished result', it is often a matter of wonder how they so long 'eluded the search of the discoverer and set at defiance the speculations of inventive genius.' * * * Knowledge after the event is always easy and problems once solved present no difficulties, indeed, may be represented as never having had any, and expert witnesses may be brought forward to show that the new thing which seemed to have eluded the search of the world was always ready at hand and easy to be seen by a merely skillful attention. *But the law has other tests of the invention than subtle conjectures of what might have been seen and yet was not. It regards a change as evidence of novelty, the acceptance and utility of change as a further evidence, even as demonstration* " (italics ours).

This case is twice cited and partly quoted in the opinion below of Judge BOURQUIN as the Rubber Co. case (R., p. 23).

Carnegie Steel Co. v. Cambria Iron Co., supra (185 U. S., 403) is also an authority on this point, since the change from what had failed to that which succeeded was apparently a very slight one. As Mr. Justice BROWN there said (p. 446):

> "The surprise is that the manfacturers of steel having felt the want for so many years, should never have discovered from the multiplicity of patents and of processes introduced into this suit, well known to the manufacturers of steel, that it was but a step from what they already knew to that which they had spent years in endeavoring to find out. It only remains now for the wisdom which comes after the fact to teach us that Jones discovered nothing, invented nothing, accomplished nothing."

Young v. Fernie, 4 Giff., 577. This is an English case involving the manufacture of kerosene (known in England as paraffine). The invention had been highly successful and involved merely the limitation of the heat of distillation to a certain determined point. The Vice-Chancellor said as to the inventor's contribution to the art:

> "I find that he has ascertained by a course of laborious experiment, a particular class of materials

> among many, and a particular process among many, which has enabled him to create and introduce to the public a useful manufacture which amply supplies the market with that which, until the use of the materials and process and temperature indicated by him, had never been supplied for commercial purposes. At the date of his patent something remained to be ascertained which was necessary for the useful application of the chemical discovery of paraffine and paraffine oils."

McClave-Brooks Co. v. Treadwell Co., 220 Fed., 144, C. C. A., 3rd Circuit, BUFFINGTON, MCPHERSON and WOOLLEY, C. Js., opinion by Judge BUFFINGTON. Here the invention was a furnace grate for the treatment of culm (exceedingly fine coal), which had formerly been a waste product of coal mining, and thus the invention involved the utilization of formerly worthless dumpage, as is true in the case at bar. The Court said (p. 145) :

> " It is clear, therefore, that any discovery which substantially contributes toward the utilization of such supposedly worthless dumpage challenges the careful attention of those charged with the administration of the patent laws."

The success of the patentee's device was due to a small change in construction. As the Court said (pp. 146, 147) :

> " Mechanically speaking, he simply double beveled the one end of an abutting, sectional dumping grate bar. As the court below rightly says ' any foundryman would know how to do it ' ; but the significance of McClave's instruction to the art did not lie in telling how to double bevel the end of a grate bar, but in disclosing the important functional use that could be made of such double beveling in successfully burning fine coal."

Moore Filter Co. v. Tonopah-Belmont Development Co., 201 Fed., 532, C. C. A., 3rd Circuit, GRAY, BUFFINGTON and MCPHERSON, C. Js., opinion by BUFFINGTON, C. J. This case was referred to and quoted in the case last cited, and is another example of an invention which resulted in the utilization of waste material, in this instance, the metal-containing dumps

of gold mines. The Court says of the inventor's problem (pp. 539, 540):

> "Practically his problem was to make commercially possible the recovery of a minute amount of valuable metal from a large quantity of mud. Of the fact, of the metal being there, there was no doubt; for the fact and, indeed, that it was possible to extract it, the tedious and costly method of laboratory filtration showed. It suffices to say that no one of the numerous patents cited did such work, used such process or effected such results; and, if none of them led their inventors or users to the use of any process whereby such work could be done or even led to a suggestion in their descriptive matter of the possibility of the use of any such process as Moore's, it follows they taught Moore no more than they taught others."

VII. *Unintentional, unrecognized, unutilized phenomena in prior art processes do not anticipate.*

Tilghman v. Proctor, 12 Otto (102 U. S., 707). Here the opinion was by Mr. Justice BRADLEY and the patent was for a process of manufacturing fat acids. Reviewing the prior art the Court said (pp. 711, 712):

> "We do not regard the accidental formation of fat acid in Perkin's steam cylinder from the tallow introduced to lubricate the piston, if the scum which rose on the water issuing from the ejection pipe was fat acid, as of any consequence in this inquiry. What the process was by which it was generated or formed was never fully understood. Those engaged in the art of making candles, or in any other art in which fat acids are desirable, certainly never derived the least hint from this accidental phenomenon in regard to any practicable process for manufacturing such acids.
>
> "The accidental effects produced in Daniell's water barometer and in Walther's process for purifying fats and oils preparatory to soap making, are of the same character. They revealed no process for the manufacture of fat acids. If the acids were accidentally and unwittingly produced, whilst the operators were in pursuit of other and different results, without exciting attention and without its even being known what was done or how it had been done, it would be absurd to say that this was an anticipation of Tilghman's discovery."

This case was cited in the opinion below by Judge BOURQUIN (R., p. 23), who says :

> " To the contention that, as in Froment's process, the agitation must entrain some air like unto that of complainants', and so the latter lacks novelty, it may be observed that if so it was unintentional and unrecognized in that Froment had in mind only flotation by quick acting gas generated *in situ*, it aided the art none and is unimportant.
>
> See *Tilghman v. Proctor*, 102 U. S., 711."

It may be further noted that this was applicable to the Froment patents, and not to the Froment description, and that in view of the fact that the minimum oil proportion disclosed in the Froment patents could not have been less than 11½ per cent. of oil, or 230 lbs. to the ton of ore, Froment's process could not have been the process in suit even if it had involved the intentional and recognized utilization of air bubbles produced by agitation.

Clough v. Manufacturing Co., 16 Otto (106 U. S., 166). Here the opinion by Mr. Justice BLATCHFORD is well summarized in the syllabus written by him :

> " 3. A prior burner was set up as anticipating the invention. If used now in a way in which it was never designed to be used, and was not shown to have ever been used, before Clough's invention, it might be made to furnish a supplementary supply of gas. But as it was not designed for the same purpose as Clough's burner, and no person looking at it or using it would understand that it was to be used in the way Clough's was used, and it was not shown to have been really used and operated in that way, it was held not to have amounted to an invention of what Clough invented."

Wickelman v. A. B. Dick Co., 88 Fed., 264, C. C. A., 2nd Circuit, WALLACE, LACOMBE and SHIPMAN, C. Js., opinion by Judge WALLACE. The Court says at page 266 :

> " The case is one for the application of the doctrine, well settled in the law of patents, that novelty is not negatived by a prior accidental production of the same thing, when the operator does not recognize the means

by which the accidental result is accomplished, and no knowledge of them, or of the method of its employment, is derived from it by any one. *Pittsburgh Reduction Co. v. Cowles Electric Smelting & Aluminum Co.*, 55 Fed., 307 ; *Chase v. Fillebrown*, 58 Fed., 377 ; *Topliff v. Topliff*, 145 U. S., 161 ; *Tilghman v. Proctor*, 102 U. S., 707, 711.

" ' The chance operation of a principle, unrecognized by any one at the time, and from which no information of its existence, and no knowledge of a method of its employment, is derived by any one, if proved to have occurred, will not be sufficient to defeat the claim of him who first discovers the principle, and, by putting it to practical and intelligent use, first makes it available to man.' *Andrews v. Carman*, 13 Blatchf., 308 ; Fed. Cas., No. 371."

VIII. *The description in a patent may be sufficient for patentability even though something is left to the skill of the user and to test and trial.*

Mowry v. Whitney, 14 Wall. (81 U. S., 620). Here the patent in suit was for a process of making car wheels. In the opinion of Mr. Justice STRONG it is said (p. 644) :

> " The specification, then, is to be addressed to those skilled in the art, and is to be comprehensible by them. It may be sufficient, though the unskilled may not be able to gather from it how to use the invention. And it is evident that the definiteness of the specification must vary with the nature of its subject. Addressed as it is to those skilled in the art, it may leave something to their skill in applying the invention, but it should not mislead them."

This case was cited in the opinion below of Judge BOURQUIN with a statement that all skilled in the mining art know that " every ore presents its own problem of reduction ", so that " while all may lend themselves to a general method, each may require some modification of the method " (R., p. 23), and Judge BOURQUIN was peculiarily qualified to express an opinion as to the mining industry.

It may be noted also that Judge BOURQUIN refers to *Wood v. Underhill*, 5 Howard (46 U. S.), 1, wherein the Court below had instructed the jury that the specification was too vague and uncertain to support the patent. Here Mr. Chief Justice

TANEY said that as to the case before the Court the patentee gave "a certain proportion as a general rule" and stated certain exceptions, that the question should have been left to the jury upon the evidence of persons skilled in the art to which the patent appertained, since the specification was addressed to those skilled in the art.

Applying this case to the case at bar, it may be noted that the patent in suit describes a specific ore and a specific oil and recommends as "suitable and economical" a specific proportion of oil to ore, to wit .1 per cent. When these instructions are carried out the process of the patent in suit is exactly carried on and its results attained. As to the limit in the range of the minute proportions mentioned in the patent in suit, .02 per cent. to .5 per cent., these limits have not been over-stepped in any of the numerous practical uses of the invention. Further the invention in the case at bar is a process of general application for dealing with a large class of substances, and in each instance exhibits its unique characteristics, which are clearly recognizable by those skilled in the art.

U. S. Mitis Co. v. Midvale Steel Co., 135 Fed., 105, C. C., E. D., Pa., ARCHBALD, D. J. Here the patent was for a metallurgical process and the invention was described in the specification as follows:

> "I have found that the use of a minute quantity, never exceeding 1 per cent. by weight—preferably from one-fifth to one-tenth of one per cent. by weight—of metallic aluminum added to the molten iron has the desired influence, and even a very much smaller percentage has an appreciable influence."

The specified quantity was, therefore, a fraction of one per cent., and the amount recommended was a very small fraction of one per cent. Moreover the result was dependent upon the physical disappearance of the aluminum. The court said (p. 108):

> "The process which he evolved may be a simple one—merely casting a bit of aluminum into the molten mass at the moment of pouring—but it is not to be judged by its simplicity, but by its effect" (Citing Carnegie Steel Co. v. Cambria Iron Co., (*supra*), 185 U. S., 403–429).

This case was referred to in the opinion of the Circuit Court of Appeals in the case at bar (R., pp. 722, 723) and the distinction made that there the patentee had "added something which had not been used by others and which was effective in producing the result which was sought" and that in the case at bar "nothing has been added". The error in this statement is almost unbelievable. In the case at bar the process in suit is the only one of those referred to in the opinion that was effective in practice in producing the flotation-concentration of ores. The prior documents relied upon as anticipative had produced nothing practical in the flotation-concentration of ores, had added nothing of value to the art of flotation-concentration of ores. The process in suit had succeeded where all others had failed and its success was due to its novel features introducing new principles and a new mode of operation.

IX. *A process exists quite independently of apparatus.*

Cochrane v. Deener, 4 Otto (94 U. S., 780). The opinion by Mr. Justice BRADLEY defines a process in the sense of the patent laws (p. 788).

> "A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing. If new and useful, it is just as patentable as is a piece of machinery. In the language of the patent law, it is an art. The machinery pointed out as suitable to perform the process may or may not be new or patentable; whilst the process itself may be altogether new and produce an entirely new result. A process requires that certain things should be done with certain substances, and in a certain order; but the tools to be used in doing this may be of secondary consequence."

This leading case was followed by many others in this court, as for example in the Telephone Cases, 126 U. S., involving the Bell telephone patent, wherein Mr. Chief Justice WAITE, who delivered the opinion, said (p. 533):

> "The patent for the art does not necessarily involve a patent for the particular means employed for using it. Indeed, the mention of any means, in the specification or descriptive portion of the patent, is only neces-

> sary to show that the art can be used; for it is only useful arts—arts which may be used to advantage—that can be made the subject of a patent. * * * Thus an art—a process—which is useful is as much the subject of a patent, as a machine, manufacture, or composition of matter."

Further in this opinion it was said (p. 536) :

> " The law does not require that a discoverer or inventor, in order to get a patent for a process, must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way of putting it into operation. This Bell did. He described clearly and distinctly his process of transmitting speech telegraphically, by creating changes in the intensity of a continuous current or flow of electricity in a closed circuit, exactly analogous to the changes of density in air occasioned by the undulatory action given to it by the human voice in speaking."

It was then said that Bell described two different apparatus with which his process could be carried out, and as to one of them it was found that it could transmit speech successfully, although not so well as another apparatus not described in the patent.

The single claim was peculiarly both for a process and an apparatus, and in so far as it was for an apparatus it was limited to an apparatus substantially as shown, but in so far as it was for a process it was given the broadest possible construction, so that in fact it dominated the art of telephony for the limited life of the patent.

It may be noted that in the opinion of the Ninth Circuit Court of Appeals in the case at bar the second above stated quotation is repeated (R., p. 719) as applied to the Froment patents, which failed to disclose a useful process. Obviously it is not the law that an unused and unusable process can be magnified and distorted by construction into a different and useful process for the purpose of anticipating a useful invention which has in fact created a new art of great value to mankind.

X. *A defense that others than the patentees are the real inventors must be proved beyond reasonable doubt.*

This point may be put forward by the defendant. It is in the evidence that Mr. A. Howard Higgins, a metallurgist of complainants, actually conducted the experiments out of which the discovery of the process of the patent in suit emerged, doing this work under the daily supervision and direction of Messrs. Sulman, Picard and Ballot, and in accordance with specific written instructions evolved at a conference of these inventors. This the defendant proved. On this evidence the argument may be presented that Mr. Higgins was the real inventor of the process in suit. But Mr. Higgins' own testimony disposes of that question, since he, testifying as a witness for the defendant, admitted that he did this work under these definite instructions, and made no claim to inventorship whatsoever. The pleadings do not set up the defense that Mr. Higgins was the real inventor, but that point was not raised by objections to the evidence, for the reason that there was no evidence to support any such defense. The evidence of all the participating parties given in behalf of defendant was quite to the contrary.

Agawam Woolen Co. v. Jordan, 7 Wall. (74 U. S., 583). Here Mr. Justice CLIFFORD says :

> " Persons employed, as much as employers, are entitled to their own independent inventions, but where the employer has conceived the plan of invention and is engaged in experiments to perfect it, no suggestions from an employee not amounting to a new method or arrangement, which, in itself is a complete invention, is sufficient to deprive the employer of the exclusive property in the perfected improvement."

The particular question here involved was whether or not suggestions made to an inventor which may have resulted in an improvement in the instrumentalities employed, deprived the inventor of his status as such. The law as stated in the above quotation was applied.

Huebel v. Bernard, 15 App. D. C., 510. Here the Court of Appeals for the District of Columbia decided upon conflicting claims of two applicants for patents. One of these applicants, Bernard, employed the other applicant, Huebel, by giving

oral instructions from which Huebel produced a device embodying the invention. The Court held that the man who conceived and directed, and not the man who made the appliance, was the inventor, and said:

> "An inventor who employs a mechanic to embody his conception in practical form retains his exclusive right to the perfected improvement notwithstanding the perfection is partly due to the exercise of the mechanical skill of the employee. The latter must invent something, not merely improve by the exercise of his mechanical skill upon a conception which he has been employed to work out" (Agawam v. Jordan, 7 Wall., 583, 603; Milton v. Kingsley, 7 App. D. C., 531).

Protector Last Co. v. Pell, 204 Fed., 453, D. C. D., N. J., CROSS, D. J. Here there was an effort to prove that the patentee had received a disclosure of the invention from others, and the Court says (p. 461):

> "Testimony of the character under consideration, adduced for the purpose of defeating a patent, should be of such dignity and weight as to satisfy a court beyond any reasonable doubt of its accuracy, or else it should unhesitatingly be rejected."

In *Eastern Bag Co. v. Continental Bag Co.*. 142 Fed., 479, C. C. D. Me., PUTNAM, C. J., very careful consideration is given to conflicting evidence that another than the patentee, to wit, the patentee's patent attorney, was either the sole or joint inventor of the invention in suit, with a review of the authorities (pp. 502–509). The finding against this contention was affirmed by the Circuit Court of Appeals of the First Circuit in *Continental Bag Co. v. Eastern Bag Co.*, 150 Fed., 731, 742, and the case finally reached this Court (*Continental Bag Co. v. Eastern Bag Co., 210 U. S., 405*), and this Court affirmed the decree below, but was not called upon to consider the attack upon the originality of the invention, the point decided here being that reasonable non-user of a patent by its owner will not justify the withholding of equitable relief against infringement.

Reference may also be here made to the quotation from Robinson on Patents at the end of the next following point herein.

XI. *A defence of improper joinder of applicants is regarded with disfavor and can be supported only by clear and unequivocal proof.*

Butler v. Bainbridge, 29 Fed., 142, C. C., S. D. N. Y. Here Judge COXE said (p. 143) :

> " The defense that defendants are not joint inventors is so purely formal in character that it cannot be regarded with favor, unless it be shown that the action of the patentees in this regard was disingenious, or calculated to mislead the defendants."

Quincey Mining Co. v. Krause, 151 Fed., 1012, C. C. A., 6th Circuit. LURTON, SEVERENS and RICHARDS, C. Js. Here Judge LURTON in the opinion of the court said (p. 1017) :

> " To destroy a patent granted for a joint invention upon the ground that it was the invention of only one of the patentees would require very clear evidence of a very reliable character."

See, also,

Sieber & Trissell Mfg. Co. v. Chicago Binder & File Co., 177 Fed., 439, C. C. N. D. Ill., SANBORN, D. J.

Godfried v. Philips Best Brewing Co., 10 Fed. Cas., 841, C. C. E. D. Wis., DYER, D. J.

1 *Robinson on Patents*, 569. This is an excellent text book of patent law and sums up the law as applicable to processes produced by experiments under the direction of joint inventors, in Section 399, as follows :

> " The same variety is possible in the exterior relations of the joint inventors where the inventive act consists in the repeated trial of experiments. The exact part which each performs is of no consequence. Nor does it matter that one has been experimenting long in vain, nor even that he may have made some actual advance toward the discovery to which he aspires. It is enough if the experiment which finally succeeds —the one which demonstrates the practicability of accomplishing the end in view, and indicates the means by which it is attainable—has been conducted under their united supervision, and in accordance with ideas and theories to which both have contributed."

XII. *A mere change of degree, as in form or proportion, along the beaten path of the art, with obvious results, and not evoking new principles or modes of operation or utilizing new functions or producing new results, is unpatentable.*

The numerous decisions on this point, particularly those of this court, have been carefully studied. No one of them is applicable to the facts of the case at bar, but defendant will probably invoke them, and the Circuit Court of Appeals in its decision below cited a few of them, as will be noted. It is believed that the following resumé will be of assistance to the Court.

Smith v. Nichols, 21 Wall. (88 U. S.), 112. Here a fabric was claimed. The novelty was that threads were held more tightly than they had been held before. The results were the obvious results of this slight change.

This is a leading case and Mr. Justice SWAYNE's statement of the law has been repeatedly cited, since its definition of an invention as a mental concept of which the machine, process or product is but the embodiment, cannot be improved upon. This definition has been heretofore quoted in this brief. What Mr. Justice SWAYNE said as to the law of degree is equally perspicuous and precise and it is quoted below in the excerpt from the next case, *Roberts v. Ryer*, and it may be added, it was also quoted in the opinion below of the Circuit Court of Appeals in the case at bar (R., p. 719).

Roberts v. Ryer, 91 U. S., 150. Here the patent was for the details of interior construction of a refrigerator. Comparing it with a prior patent for a usable and used refrigerator, Mr. Chief Justice WAITE, in the opinion of this court, said at page 159:

> "There was no change in the machine: it was only put to a new use. If there was any change of construction suggested, it was only to increase its capacity for usefulness. It was 'A mere carrying forward or new or more extended application of the original thought, a change only in form, proportions or degree, doing substantially the same thing in the same way, by substantially the same means, with better results.' This is not such an invention as will sustain a patent. We so decided no longer ago than the last Term, in *Smith v. Nichols*, 21 Wall., 112."

Milligan & Higgins Glue Co. v. Upton, 97 U. S., 3. Here the invention claimed was a product consisting of "the ordinary flake glue reduced to small particles by mechanical division" (p. 5).

The results were the obvious results that it dissolved more readily, and that it could be packaged more easily. There were no other advantages. It was held not to involve invention.

Pearce v. Mulford, 102 U. S., 112. Here the claims were for jewelry chains. The same construction had been known and used in jewelry bracelets, and a very similar construction in jewelry chains. The slight differences were held to be obvious and unpatentable.

Slawson v. Grand Street Ry. Co., 107 U. S., 649. Here the patent was for a fare-receiving box and the novelty was putting an additional window in it, with the obvious result that a passenger could look through the window and see the inside of the box. Prior fare boxes had been provided with windows in front. The patent added a window in rear. Held unpatentable.

Estey v. Burdett, 109 U. S., 633. Here the claims were for improvements in reed organs. The advantages attained were old and well known. The novelty appeared to reside in the length and size of valve openings. This court concluded that this was a matter of judgment, in view of the state of the art, which showed that these dimensions were usually varied by the manufacturers with full comprehension of all the results from such variations. In fact, however, a proved anticipating prior use was controlling.

Munson v. City of New York, 124 U. S., 601. The patent was for a system of bookkeeping, and a bond book having a slightly altered arrangement. It was held not to involve patentable invention.

Burt v. Evory, 133 U. S., 349. Here the claims were for a construction of boots or shoes. Prior structures were almost identically the same as the structure claimed. There were no new functions or results—it was merely an obvious change in the form and arrangement of the constituent parts of a shoe.

Ansonia v. Electrical Supply Co., 144 U. S., 11. The claims were for a method of insulating electric wire, consisting of applying a layer of fibrous material, then applying a

layer of paint, then applying another layer of fibrous material before the paint dried. There was also a claim for the product of this process. The process was old, applied to and using the same materials. The alleged novelty was a discovery of incombustibility which was not required in the anticipating prior use, but nevertheless was present. *Roberts v. Ryer (supra)* and *Smith v. Nichols (supra)* were cited and the patent was held to be void.

Belding Mfg. Co. v. Challenge Corn Planter Co., 152 U. S., 100. The patent in suit contained a single claim for details in the construction of a refrigerator and the decision closely follows that of *Roberts v. Ryer (supra)*, which was in the same art and dealt with a part of the prior art bearing upon patentability. The details claimed were held to be anticipated by a prior device by the application of the rule of *Roberts v. Ryer.*

Commercial Mfg. Co. v. Fairbank Canning Co., 135 U. S., 176. This case was cited by the Circuit Court of Appeals in the case at bar (R., p. 720) as an authority for the fact that mere differences of degree are not patentable. The real point of the decision was that a domestic patent expired with the expiration of an earlier foreign patent to the same inventor for the same invention. The question of degree did, to some extent, arise by reason of small differences between the disclosures of the prior Austrian patent and the later American patent, and the case is a good example of mere differences of degree. Identity of invention was apparent and the later American patent was held to have expired with the earlier Austrian patent.

De Lamar v. De Lamar Mining Co., 117 Fed., 240, C. C. A., Ninth Circuit, GILBERT, ROSS and MORROW, C. Js. This appears to have been the controlling decision dominating the opinion of the Circuit Court of Appeals in the case at bar. The crux of this decision is, however, that the process involved merely economy in proportions in a known use of a known agent in a known process used in the art, and

> " involved in it no discovery, but only the exercise of ordinary prudence and skill " (p. 249).

Obviously there were here involved the old principles, the old mode of operation, giving a better result from mere

economy. The change was only a change in degree and not in kind. This appears from the opinion of Judge GILBERT, concurred in by Judge MORROW, differing from Judge ROSS's opinion in holding that the claims which did not disclose definite proportions would nevertheless have been valid had the invention been patentable, notwithstanding the fact that exact quantities were not specified in the claims. In this opinion it is said (pp. 248, 249):

> "The appellant was not the inventor of the use of zinc dust, by means of agitation, for the purpose described in his claims. That use being already known in the art, his patent is left to rest upon his claim of the use of a definite quantity. This claim, we think, cannot be made the subject of patent. Conceding that the appellant and others had the right to use zinc dust, and to use it by means of agitation, it must follow that they would have the right to use such quantity as would best accomplish the result desired. The appellant cannot take from them that right, or the right to experiment, and adjust the quantity of material, by asserting that he is the first discoverer of the use of definite quantity, or the exact quantity, which will precipitate all the mineral in the solution. If all the claims of his patent are good, it follows that others can only avoid infringement by using zinc dust in an unskillful way, by either using too much or too little. The right to use the dust being free to all, we think it follows, necessarily, that all have the right to adjust the quantity of the material to the necessities of each case, and to ascertain by experiment or analysis, if need be, the quantity that may be required to produce the desired end, and that such a use cannot be made the subject of monopoly, there being involved in it no discovery, but only the exercise of ordinary prudence and skill."

The last sentence above quoted is quoted by Judge GILBERT in the opinion of the Circuit Court of Appeals in the case at bar (R., pp. 719, 720). The error in application to the case at bar appears from the concluding words of the quotation, that the process "involved in it no discovery, but only the exercise of ordinary prudence and skill." It is evident that what was here put forward as a patentable invention involved merely the elemental chemical operations of solution and precipitation, and had been determined by the exercise of

the ordinary judgment of the chemist and metallurgist. It was the old principle, the old mode of operation, with an adjustment of proportions such as produced most economically the old result.

Fried. Krupp Aktien-Gesellschaft v. Midvale Steel Co., 191 Fed., 588 C. C. A., 3rd Circuit, BUFFINGTON and LANNING, C. Js. and YOUNG, D. J., opinion by BUFFINGTON, C. J. This case was also cited in the opinion of the Circuit Court of Appeals in the case at bar (R., p. 719) and the following quoted from it:

> "But mere useful and economical administrative methods, however, valuable, while they may and usually are incident to invention, do not themselves constitute invention."

This was said by Judge BUFFINGTON (p. 600) of a process of hardening armor plates by a treatment known as Harveyizing, which was old, well known in the art, and of world-wide use prior to this Krupp patent. In this old process the patentee rearranged the material treated, which did not alter the process at all, and amounted to mere duplication, and it was in connection with this that the statement above quoted was made. And Judge BUFFINGTON further said (p. 601):

> "Mere simultaneous treatment of two objects by the same process previously applied to one is not invention."

Brady Brass Co. v. Ajax Metal Co., 160 Fed., 84, C. C. A., Third Circuit, GRAY, C. J., and MCPHERSON and CROSS, D. Js., opinion by GRAY, C. J. This case, cited in the opinion of the Circuit Court of Appeals in the case at bar (R., p. 720), is a very good example of a mere change in degree. The patent was for a product, an alloy containing copper, tin and lead, in certain definite proportions, and it clearly appeared that, as compared with prior alloys, it had the same characteristics, chemical, physical, and mechanical, but in a different degree (p. 89), and that as it was approached there was a gradual improvement (p. 90). The Court said:

> "A mere difference in the proportions of the constituents of an alloy, however useful the result may be,

This case of *De Lamar v. De Lamar Mining Co.* (*supra*) is in striking contrast with the case at bar wherein the minute oil proportion evoked new principles, a new mode of operation, a new result, and the process, when discovered, was as much a surprise to the inventors as it was to the metallurgical art. The minute oil proportion not only produces a new and surprising result, but is critical, although varying slightly with different oils and different ores. With any increase in the amount of oil or any decrease in the amount of oil the new mode of operation does not proceed and the new result is destroyed. Further, the fact that there is no record or evidence of any prior practical use in the art wherein oil and air bubbles co-acted to the production of a mineral froth, accentuates the fact that no comparison is justifiable between the prior art and the invention in suit based upon the amount of oil used. Without any question the invention in suit involves a change in kind and not in degree. *De Lamar v. De Lamar Mining Co.* is therefore clearly distinguishable from the case at bar.

does not entitle the originator to the monopoly of a patent, in the absence of other circumstances than those here disclosed."

In the series of experiments which ended in the discovery he process in suit in the case at bar, after all the factors been assembled, the progressive reduction in the oil pro-tions caused a progressively poorer result and the final ppearance of the Cattermole process under investigation, thereafter, as the reduction continued toward the vanish-point, the sudden appearance of the new process embody-a new principle and a new mode of operation, and giving a and different and incomparably superior result—metal ation instead of metal sinking, utilization of air bubbles ead of their rejection, a floating mineral froth instead of ken granules of metal particles agglutinated together by

Bullock Electric Mfg. Co. v. General Electric Co., 149 ., 408, Circuit Court of Appeals, 6th Circuit, LURTON, ERENS and RICHARDS, C. Js. Opinion by SEVERENS, C. J. s case was cited in the opinion of the Circuit Court of peals in the case at bar as an authority on degree (R., p.). Here the inventor pursued the beaten path and saw y how the means already known and practiced ld be improved in detail, exercising the skill his calling and by changes in form achieving the result in kind with some improvement in degree. The ntion related to armature cores for dynamo electric ma-nes. The improvements involved no change in the prin-le or mode of operation or functions, " nothing beyond the ere of the common intelligence of those conversant with art " (p. 416).

Lauman v. Urschel White Lime Co., 136 Fed., 190, Circuit rt of Appeals, 6th Circuit, LURTON, SEVERENS and RICHARDS, Js., opinion *per curiam*. The court says of the alleged in-tion (p. 192) :

> " Nothing but an acquaintance with the usual processes of slaking lime, and the exercise of ordinary powers of observation and deduction, were required to suggest this change."

The result was old, the principles and mode of operation were old, and the suggestion of the change was obvious.

The case last above referred to was also cited as authority on the question of degree by the Circuit Court of Appeals in the case at bar (R., p. 720). Additionally *Tilghman v. Proctor (supra)*, 102 U. S., 707, was cited, but that case is excellent authority for the rule that apparent changes in degree may involve inventive faculty of the highest order. Tilghman's claim was (p. 729) :

> " the manufacturing of fat acids and glycerine from fatty bodies by the action of water at a high temperature and pressure."

and the claim was held to be valid and broadly construed.

The last authority cited on the question of degree by the Circuit Court of Appeals in the case at bar is *Guidet v. City of Brooklyn*, 15 Otto (105 U. S., 550). Mr. Chief Justice WAITE, delivered the opinion of the Court. The patentee had reissued a patent for a narrow invention, and by broadening his claims had " left the field of invention and entered that of mechanical skill only " (p. 552).

> " This was simply carrying forward the old idea, and doing what had been done before in substantially the same way, but with better results. The change was only in degree and, consequently, not patentable."

XIII. *Infringement is not avoided by added improvements.*

Tilghman v. Proctor (*supra*), 102 U. S., 707. Here Mr. Justice BRADLEY said as to alleged improvements by the defendant which was put forward as evidencing noninfringement (p. 731) :

> " Or, if the mode of effecting the continued mixture adopted by the defendants should be deemed a new and useful improvement, they might perhaps have a patent for that peculiar device without being entitled to use Tilghman's process, on which it is but an improvement."

Smith v. Nichols (*supra*), 88 U. S., 112. Here Mr. Justice SWAYNE said (pp. 118, 119) :

> " A patentable invention is a mental result. It must be new and shown to be of practical utility. Everything with the domain of the conception belongs to him who conceived it. The machine, process or product is but its material reflex and embodiment. A new idea may be ingrafted upon an old invention, be distinct from the conception which preceded it, and be an improvement. In such case it is patentable. The prior patentee cannot use it without the consent of the improver, and the latter cannot use the original invention without the consent of the former."

XIV. *A prior application for a patent or an unpublished document is neither a prior patent, nor a prior publication, nor is it prior art. It goes merely to the issue of originality or priority with respect to the precise invention in question.*

In the case at bar the Circuit Court of Appeals, in determining the question of invention—*i. e.*, whether the departures that the patentees in suit made from the prior art required and involved patentable invention—considered as a part of such prior art two subsequently issued and published patents which at the date of the filing of the application for the patent in suit (May 29, 1905) existed only as then pending applications in the secret archives of the Patent Office (namely, Schwarz, patent 807,503, applied for in May, 1904, and granted in December, 1905, and Kirby patent 809,959, applied for December 14, 1903, and granted January 16, 1906) and a certain private document that was never published but was known to the patentees in suit, or some of them, prior to the making of the invention in suit (namely, Complainants' Exhibit, Froment description, R., p. 406, Translation, p. 409).

Thus the Circuit Court of Appeals (R., p. 716) says :

> " Turning to the patents which are adverted to *as showing the prior art*, we find the following " (italics ours),

and then follows a discussion of the Haynes, Everson, Schwarz, Kirby and Froment patents (R., pp. 716, 717), the

Froment private instructions (p. 718), and certain Cattermole patents.

Again, on page 718, the Circuit Court of Appeals says:

> "When the claims and the description of the process of the appellees' patent are compared *with the patents of the prior art*, it will be seen that the only material difference is in the smaller quantity of oil which the appellees use" (italics ours),

and then follows a specific reference to the Froment process of the private instructions and to the Kirby patent.

Again, on page 720, the Circuit Court of Appeals says:

> "But it is said that the appellees' process is the only froth process, and that the processes described *in the prior art* are the bulk flotation or oil buoyancy process" (italics ours).

and thereafter follows a discussion which includes the Kirby patent.

Again, on page 720, the Circuit Court of Appeals says:

> "The contention is made, however, that if indeed the *prior patents* disclose froth processes, the scum which the appellees' process causes to rise to the surface of the water, is so different from the froth or scum which arises under the *prior art*, that it is a new result, and is not anticipated by anything *in the prior art*" (italics ours).

and the discussion that follows is "as to all of these processes" and the statement is made:

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth *in all these processes* is the same, with the exception that there is less oil (as there must necessarily be), in the appellees' froth than in the others." (Italics ours.)

It was error of law for the Circuit Court of Appeals to include as within the prior art and to consider as prior art for the purposes of the question of invention—*i. e.*, the question whether in view of the prior art an admitted change or changes

constituted patentable invention—descriptions and disclosures that at the time the invention in suit was made existed only in the form of then pending applications for patents in the secret archives of the Patent Office, or in unpublished private descriptions even when brought home to the knowledge of the patentees prior to the making of their invention.

But there would appear to be diversity and difference as to this proposition of law among the several Circuit Courts of Appeals, and the Court of Appeals for the District of Columbia.

Thus, in the case at bar, the Circuit Court of Appeals for the Ninth Circuit, while not discussing the question, acts upon the assumption that the disclosures of prior applications and of unpublished documents constitute a part of the prior art.

So also perhaps the Circuit Court of Appeals for the Sixth Circuit, in 1904, in *Drewson v. Hartje Paper Mfg. Co.*, 131 Fed., 734, where it was apparently held that an earlier application might be regarded as an anticipating patent, and this for the purposes of a question of patentable invention.

So perhaps also the Court of Appeals for the District of Columbia, in *Millett v. Duell*, 18 App. D. C., 186; 96 O. G., 1241; 1901 C. D., 410, where it was apparently held that a prior application is competent "to show the state of the art" for the purposes of a question of patentable invention.

To the contrary is a decision of the Circuit Court of Appeals for the Second Circuit in 1913, in *Vacuum Engineering Co. v. Dunn*, 209 Fed., 219, where the necessity of publicity is pointed out for anything that is to be considered as a part of the prior art, an element which an application for patent lacks so long as it remains a mere application. Citing its own prior decision in *Westinghouse Mfg. Co. v. General Electric Co.*, 207 Fed., 75.

So again in 1915 the Circuit Court of Appeals for the Second Circuit in *Autosales Gum & Chocolate Co. v. Ryede Specialty Works*, 223 Fed., 1021, affirming the opinion of the Court below, 222 Fed., 956, where the court below said (p. 957):

> "It is contended that a later Cook patent, No. 664,235, granted December 18, 1900, application for which was filed on February 15, 1900, should also be

considered as in the prior art; but this patent must be excluded under the authority of such cases as *Bates v. Coe*, 98 U. S., 31, 25 L. Ed., 68; *Vacuum Engineering Co. v. Dunn*, 209 Fed., 219, etc."

So the Circuit Court of Appeals for the Third Circuit in *Diamond Drill & Machine Co. v. Kelly Bros.*, 120 Fed., 282 (1902); affirmed 123 Fed., 882; reaffirmed 129 Fed., 756; *Certiorari* denied by this Court, 198 U. S., 584; where a description that was prior as an application but subsequent as a patent was held immaterial on the questions of anticipation and patentable invention, citing *Bates v. Coe*, 98 U. S., 31.

So the same Circuit Court of Appeals for the Third Circuit in *Union Typewriter Co. v. L. C. Smith & Bros.*, 173 Fed., 288 (1909); affirmed, 181 Fed., 966.

So again the Circuit Court of Appeals for the Third Circuit in *Johns-Pratt Co. v. E. H. Freeman Electric Co.*, 201 Fed., 356 (1912); affirmed on the opinion of the Court below, 204 Fed., 288; where the Court below had said, referring to a certain Downes patent (p. 360):

> "This patent notwithstanding it was cited by the examiner as an anticipation of the patent in suit as a matter of fact is not found in the prior art. It was issued in January, 1900, which, although prior to the date of the issue of the patent in suit, was subsequent to the filing of the application therefor, and consequently Downes cannot properly be cited as an anticipation of it. *Bates v. Coe*, 98 U. S., 31, etc."

So the Circuit Court of Appeals for the Seventh Circuit in *Gray Telephone Pay Station Co. v. Baird Mfg. Co.*, 174 Fed., 417 (1909), where the Court says:

> "Defendant cites Gentry patent No. 516,433, granted March 13, 1894, for a telephone toll station, and Alexander patent No. 544,077, granted August 6, 1895, for improvement in coin-signal apparatus for telephone pay stations. The application for the patent in suit was filed November 17, 1893 (Gentry application, April 6, 1893; Alexander application, November 13, 1893). It thus appears that at the time the application for the patent in suit was filed these two alleged anticipating patents were not in the prior art, and cannot

be availed of as anticipations. *Bates v. Co.*, 98 U. S., 31, etc." (Parenthetical insertion ours.)

So the Circuit Court of Appeals for the Eighth Circuit in *Anderson v. Collins*, 122 Fed., 451 (1903), where the Court, speaking of a Bender & Mueller description, which, as an application was earlier, but as a patent was later, than the application for the patent in suit, said, p. 458 :

> " The Bender and Mueller patent is in evidence here to establish the statutory defense that Collins' combination had been patented prior to his invention or discovery thereof. * * * As to the patent to Bender and Mueller was not issued until after Collins conceived and perfected his patented device, nor until after he had applied for a patent for it, it is neither competent or material evidence upon the issues in this case. *Bates v. Coe*, 98 U. S., 31, 33, 34 ; *DuBois v. Kirk*, 158 U. S., 58, 64 ; *Walker on Patents*, Sec. 55, page 53."

The true legal effect of the description contained in an application in the secret files of the Patent Office and the only defense to which it is material evidence are set out by the Circuit Court of Appeals for the Second Circuit in *Sundh Electric Co. v. Interborough Rapid Transit Co.*, 198 Fed., 94 (1912), where the Sundh patent there in suit was held void on the ground that one Ihlder and not Sundh was the original and first inventor, the only evidence of that fact being the prior existence of an Ihlder application, for the very same invention, in the secret archives of the Patent Office. Ihlder's date of application was June 10, 1902 ; Sundh's date of application was March 16, 1903. Sundh's patent issued July 14, 1903 ; Ihlder's patent issued October 20, 1903. No oral or other testimony carried the date of either invention back of the respective dates of filing application. The Court said, page 96 :

> " Ihlder's device was certainly not patented before Sundh's invention, which was completed by reduction to practice on the day the latter filed his application. Nor was Ihlder's application, although it completed his invention by reducing it to practice on the day such application was filed, a ' publication ' within the mean-

ing of the statute, because it remained unpublished in the secret records of the Patent Office until after Sundh's application had been filed. The Ihlder patent, therefore, was no part of the prior art.

It is contended, however, that the court erred in not sustaining a separate defense based upon the Ihlder patent, viz., the defense enumerated in the fourth subdivision of section 4920, U. S. Rev. Stat. (U. S. Comp. St. 1901, p. 3395):

> 'That (the patentee) was not the original and first inventor or discoverer of any material and substantial part of the thing invented.'

This is a separate and distinct defense from the third one, and while evidence is not admissible to carry back the date of a later patent, by showing that application for it was filed earlier, the fact that the person who took out such later patent was himself the original and first inventor of the invention in controversy earlier than the plaintiff may be proved, as any other fact is, by competent proof. *Barnes Automatic Sprinkler Company v. Walworth Mfg. Company*, 60 Fed., 605, 9 C. C. A., 154; *Diamond Drill Machine Company v. Kelly Brothers* (C. C.), 120 Fed., 295."

In order to maintain this defense, said the Court (p. 97):

> " it must, of course, appear that the invention of the patent in suit and the invention of the prior application are the same. Thus in Diamond Drill Company v. Kelly, *supra*, the patent in suit dealt with a belt-fastener, the prior application with a bed-spring. That court held that even though it should be found that these were analogous arts, and that the presence of either in a prior field of art left no room for invention in the production of the other, it could not be said that both had invented the same thing."

The court then compared the Sundh and Ihlder claims and devices and said (p. 98):

> " Each of these claims reads with great precision upon the devices of both patents. Since both were pending in the Patent Office at the same time, interference should have been declared. Complainant urges the non-action of the Patent Office as an argument in favor of the proposition that it must have been held by the officials that there were patentable differences between the two structures which made inter-

ference unnecessary. There seems to us to be such identity that we can account for the failure to declare interference only on the theory of oversight. If the claims of the Sundh patent are to be construed as covering an invention so broad as to include defendant's device, and we think, in view of the prior art, that they may be so construed—then the invention they cover was reduced to practice by Ihlder's application of June 10, 1902, and complainant cannot maintain this suit, because it has been shown that he (Sundh) was not the original and first inventor of that invention."

The distinction here made is a simple and a clear and a sound one. An earlier description existent only in the secret archives of the Patent Office in the form of an application for patent is not a prior patent nor yet is it a prior publication, and so is not an anticipation in that sense, and, as it remained unpublished in the secret archives of the Patent Office, it forms no part of the prior art. It is unknown to, and inaccessible to, and cannot be made use of by, the man skilled in the art. It is no part of general knowledge or even of special skill in the art. It is therefore irrelevant and immaterial on the question of invention—*i. e.* the question whether or not, in view of the state of the art, and in view of the knowledge of the man skilled in the art, it required or involved invention to do what the patentee in suit did.

On the other hand where the question is whether or not the patentee in suit was the original and first inventor or discoverer of the thing patented, then such earlier application is admissible and material as evidence tending to show that someone other than the patentee in suit was, in fact, "the original and first inventor or discoverer."

These are separate and distinct defenses, as is pointed out in the last above case; and in order to maintain the last defense, namely, that the patentee in suit was not the original and first inventor or discoverer it must appear that the invention set forth in the earlier application was, in fact, the very invention patented in the patent in suit. Under these circumstances only is an earlier application admissible in evidence or material, and it is material then only on the issue of first and original inventorship. Under no circumstances is such earlier application admissible or material as constituting a part of the prior art or on the

issue of invention over the prior art or on the issue of anticipation by prior patent or publication. Doubt as to the substantial identity of the disclosure of such earlier application with the invention of the patent in suit is fatal even to the defense of prior invention. This was held by the Circuit Court of Appeals in the Second Circuit, in *Hillard v. Fisher Book Typewriter Company*, 159 Fed., 439.

Thus the decision of the Circuit Court of Appeals of the Sixth Circuit in *Drewson v. Hartje Paper Co.*, 131 Fed., 734 *(supra)*, and the decision of the Court of Appeals of the District of Columbia in *Millett v. Duell*, 18 App. D. C., 186 *(supra)*,, appear to be in conflict with the above decisions of the Circuit Courts of Appeals of the Second, Third, Seventh and Eighth Circuits, and in conflict with the decision of this Court in *Bates v. Coe*, 98 U. S., 31, on which the latter were based; and the decision of the Circuit Court of Appeals of the Ninth Circuit in the case at bar is undoubtedly in conflict with all the above cited decisions of the Second, Third, Seventh and Eighth Circuits, as well as with the decision of this Court in *Bates v. Coe, supra.*

The Circuit Court of Appeals of the Sixth Circuit, in 1905, in *Johnson v. Foos Mfg. Company*, 141 Fed., 73, apparently modified its holding in *Drewson v. Hartje Co.* (*supra*), of the previous year, saying (p. 81) :

> " The method of Burnham, whether workable or not, was not the process of Johnson, and his patent is not an anticipating patent for that reason as well as because it had not been issued at the date of the Johnson application (*Bates v. Coe*, 98 U. S., 31 ; *Dubois v. Kirk*, 158 U. S., 64 ; *Anderson v. Collins*, 122 Fed., 451, 58 C. C. A., 669."

And in 1909 that same Circuit Court of Appeals for the Sixth Circuit, in *Electric Controller & Supply Co. v. Westinghouse E. & M. Co.*, 171 Fed., 83, seems to construe its own earlier decision in *Drewson v. Hartje Co.* (*supra*), and to limit (like the Circuit Court of Appeals of the Second Circuit in *Sundh Co. v. Interborough Co., supra*), the admissibility and materality of a prior application as evidence to the case where

it discloses substantially the same invention as the patent in suit. The Court says (p. 87) :

> " The date of the filing of the Davis application (as well, in fact, as the date of the patent) thus antedate the corresponding dates of the Lange & Lamme patent. If, therefore, the two applications disclose substantially the same subject-matter, in the absence of any other evidence of the date of invention, the date of the first application would *prima facie* be taken as the date of the first invention (*Drewson v. Hartje Paper Mfg. Co.*, 131 Fed., 734, 739, 65 C. C. A., 548)."

The only disclosure in the Davis application of the subject-matter of the Lange & Lamme patent was incidental to a certain Fig. 4 of that application, and it was not claimed by Davis as his invention. Davis, on the witness stand, testified that he did not design the form of construction shown in Fig. 4 of his application, but simply copied it from something in the Westinghouse shops, where Lange & Lamme did all the designing. Moreover, he identified certain Lange & Lamme drawings showing the construction, and of a date several months prior to the Davis date of application. The Court continues :

> " The charge contained in the answer of a surreptitious patenting by Lange & Lamme of a patent invented by Davis is thus rebutted; * * * The Davis patent may thus be disregarded."

If the decision in *Drewson v. Hartje* (*supra*) is understood to be explained and limited by the subsequent decisions of the same Court in *Johnson v. Foos* (*supra*), and *Electric Co. v. Westinghouse Co.* (*supra*), and so limited and explained is to be understood as confining the materiality of an earlier application as evidence to the case where such earlier application shows substantially the same invention as the patent in suit, and where it is addressed to the single issue of priority of invention as between that earlier applicant and the patentee in suit, then the decision of the Circuit Court of Appeals of the Ninth Circuit in the case at bar stands alone and unsupported, except as it may receive support from the decision of

the Court of Appeals of the District of Columbia in *Millett v. Duell*, 18 App. D. C., 186; 96 O. G., 1241; 1901 C. D., 410 (*supra*).

Millett v. Duell (supra) is important as indicating the practice in the Patent Office. The language of the Court there is broad. The Court says:

> "It is not the fact that a patent was issued to Lane upon his application which constitutes anticipation in this case. Although that patent was issued in so short a time after the application of the appellants (three days after) that, in view of the usual and necessary course of business in the Patent Office, we might fairly assume that the facts which justified its issue had been satisfactorily shown long before the advent of the appellants to the Office, yet the patent of itself would not be sufficient to show anticipation by Lane of the device of the appellants. But the fact which shows such anticipation is *the state of art* at the time *as evidenced by the drawings and specifications of Lane's application*. For it is the condition of the art at the time at which an alleged invention is made, and not the existence of a patent which in this connection is no more than evidence of the state of the art, which determines whether an invention claimed is actually an invention or not under the patent law. And this state of the art may be shown by a printed book, a periodical publication, a newspaper, anything in fact which can be regarded in law as reasonably sufficient proof of the fact. This we understand to be the rule deduced from reason and the authorities. [See *Wright v. Yuengling*, 60 O. G., 639, 155 U. S., 47] (italics ours).

But the facts there show that the Court used language loosely and in terms went much farther than the case before it required. The Lane application had been filed almost two years ahead of the Millett & Reed application and the Lane patent issued about three days after the Millett & Reed application was filed. The subject-matter claimed by Millett & Reed was not claimed in the Lane application and was not described in the Lane application, but was shown in one of the Lane drawings, and the only serious contest in the case was on the question of fact whether that drawing really showed the subject-matter claimed by Millett & Reed or not. All of the tribunals of the Patent Office had held that it did and the Court

so held also. The Court said that Lane's failure to claim the device as of his own invention "simply implies either that he abandoned it to the public, or that he regarded it as already well known to the art."

The facts, therefore, made the action of the Patent Office and of the Court perfectly sound and correct in rejecting Millett & Reed's claim, because those facts show that Millett & Reed were not the first and original inventors of the device, and this was true, not because it belonged to the prior art or because Lane's application was evidence as to the state of the art, but simply because Lane's prior application was evidence negativing the priority of Millett & Reed.

Wright v. Yuengling, 155 U. S., 47, cited by the Court of Appeals of the District of Columbia, went merely to the question whether a drawing without a description could be accepted as sufficient evidence of construction. It is there held that it could be, and in Millett v. Duell it was held that the drawings in question were a sufficient and complete disclosure of the construction claimed by Millett & Reed. Probably no more was intended to be decided in *Millett v. Duell* than was decided in *Ex parte Eddleblute*, 52 O. G., 751, 1890, C. D., 124, where Commissioner MITCHELL, in dealing with the case of the very subject-matter of a claim being shown in an earlier application, so that the applicant for the claim, so far as the Patent Office records showed, was apparently not the first inventor, says :

> "In cases like the present applicant should at least be required to make such showing before the Office as to overcome the presumption which the Office always recognizes in favor of the earlier application and of the patent issued upon the earlier application.
>
> Inasmuch as in the present case the application upon which the patent was granted was filed at an earlier date than the application against which it was cited, the Examiner's action in rejecting the later application and requiring an oath under Rule 75 is sustained and the petition is denied."

This latter case illustrates the practice of the Patent Office and its true basis, namely, that where *the very subject-matter of a claim* is found fully disclosed in an earlier filed applica-

tion, the maker of the claim is by that record presumptively shown to be not the first inventor.

The holding in *Millett & Reed v. Duell* has the same sound basis in reason, but this basis does not assume or require that the disclosure of the earlier application, while it remains a mere application, necessarily evidences the state of the art or the condition of the art at that time.

So that the decision of the Circuit Court of Appeals for the Ninth Circuit in the case at bar really stands alone and unsupported by authority; for it not only describes as showing the prior art, subsequent patents issued on prior applications, and a private document that never became public at all except as it became a part of the record in this suit, but it weighs and considers the disclosures of those patents and of that document in determining the question of patentable invention in the case, as only that knowledge and those patents can be weighed and considered that were known or could be known to persons skilled in the art.

The decision of the Circuit Court of Appeals in the case at bar is contrary to the decision rendered in this Court in *Bates v. Coe*, 98 U. S., 31.

The last named case is cited in most of the cases referred to above in the Circuit Courts of Appeal for the Second, Third, Seventh and Eighth Circuits, and is the basis of those decisions.

It is particularly discussed by the Circuit Court of Appeals for the Seventh Circuit in *Barnes Automatic Sprinkler Co. v. Walworth Mfg. Co.*, 60 Fed., 605, where it is pointed out that the passage so often quoted from *Bates v. Coe, supra* (to the effect that a defendant cannot be permitted to prove that the invention described in a prior patent was made prior to the date of the patent), refers, and can refer, only to the defense of anticipation by prior patent or prior publication, and cannot refer to the defense of prior invention by another, that is to say, to the defense that the patentee was not the first and original inventor.

This understanding of *Bates v. Coe* has been general in the Circuit and District Courts, as well as in the Circuit Courts of Appeals.

In addition to the cases referred to above are the following in this connection:

Thomson-Houston Electric Co. v. Ohio Brass Co., 130 Fed., 542 (HALE, J., First Circuit, 1904).
General Electric Co. v. Allis-Chalmers Co., 190 Fed., 165 (CROSS, J., Third Circuit, 1911).
American Roll Paper Co. v. Weston, 45 Fed., 686 (SAGE, J., Sixth Circuit, 1891).
Farmers' Handy Wagon Co. v. Beaver Silo & Box Mfg. Co., 219 Fed., 234 (GEIGER, J., Seventh Circuit, 1914).
Turner Brass Works v. Appliance Mfg. Co., 203 Fed., 1001 (KOHLSAAT, J., Seventh Circuit, 1909).
Alvord v. Smith & Watson Ironworks, 216 Fed., 150 (WOLVERTON, J., Ninth Circuit, 1914).

In some of these cases the point is made, and very properly made, that a disclosure made in an application in the secret archives of the Patent Office lacks the element of publicity to constitute it a part or any part of the state of the art at that time. While the absence of publicity would not be material or fatal to the defense that the patentee in suit was not the first and original inventor, it would be material and fatal to the defense of lack of novelty or lack of invention over the prior art. For the latter defenses are predicated upon the proposition that the public was already in possession of that which the patentee purported to give it, so that the consideration passing from the applicant to the public for the grant of the monopoly failed. The defenses of want of novelty and want of invention are predicated, and must in the nature of things be predicated, upon the knowledge that one skilled in the art would possess, or could possess, in view of all that was published and public and accessible. Knowledge confined to the pages of an unpublished application in the secret files of the Patent Office, or to the pages of an unpublished private document, like the Froment description, manifestly was not public or available to the public or to those skilled in the art, and manifestly could form no part of that general skill in, or knowledge, of, the art.

The Circuit Court of Appeals for the Ninth Circuit in the case at bar has treated the Kirby and Schwarz patents, which became public and accessible to the public only after the ap-

plication for the patent in suit was filed, and has treated the Froment description, which never became public until divulged in the record in this case, all as if they and the processes and the knowledge disclosed in them had belonged to the public prior to the filing of the application for the patent in suit and prior to the making of the invention in suit, and had been known to the man skilled in the art prior to that time and accessible and available to him and to any one, and that taken in connection with other things known and shown in the prior art they robbed what the patentees in suit did of the quality of invention. From these secret applications and from that private document, said the Circuit Court of Appeals in effect, taken in connection with other patents in the prior art, any one could have worked out the process of the patent in suit without exercising invention, any skilled worker in the art would naturally have done what the patentees in suit did.

The mere statement of this proposition constitutes its refutation.

Our conclusion upon authority and reason is that, whereas the disclosure of an earlier pending application or of an unpublished document, *if it shows the very invention in issue* (which none of the documents here in question do), is competent and material evidence that the patentees in suit were not the first and original inventors, it is not competent or material either on the issue of anticipation by the prior patent or publication or on the issue of want of patentable invention in view of the state of the art.

To sum it up a little differently, if the earlier application shows the very thing claimed, it is a sound reference and a good defence as evidencing that the applicants for the patent in suit were not the first inventors of that very thing ; but if it does not disclose the very invention in question, it is not competent or material for any purpose, and above all it cannot be combined and compounded with, and supplemented by, the actual disclosures of the prior art to support the defense of want of patentable invention over that art.

In the case at bar neither Kirby, nor Schwarz, nor the Froment description, showed the very invention here in issue. On none of them could the claims here in issue have been predicated. And this is found to be a fact by the Circuit Court of Appeals in this very case. Consequently, these

Kirby and Schwarz publications and the Froment instructions are incompetent and immaterial for any purpose, and it was error for the Circuit Court of Appeals to consider and regard them on the question whether the changes that the patentees in suit made over the prior art involved or required invention.

The Cattermole, Sulman and Picard patent No. 788,247 and the Sulman and Picard patent No. 793,808 referred to in the evidence, but not referred to in the opinion of the Circuit Court of Appeals, are also not prior patents, and all that has been said above as to applications priorly secretly filed in the Patent Office, is equally true as to these two applications and belated patents. This is also true as to the Wolf patent No. 787,814, as the controlling date of the invention in issue is at latest April 12, 1905, the date of the filing of the British application corresponding to the application for the patent in suit (*supra*, p. 136), which is earlier than the issue date of the Wolf patent, April 18, 1905. In fact, however, the controlling date as against an infringer should be the actual date of invention abroad, and therefore March 10, 1905, the invention having been made in the week between March 3 and March 10, 1905, as has heretofore fully appeared. This court has never spoken on this point, but such is the interpretation of the law in the Second and Third Circuits.—*Hanifen v. Godshalk Co.*, 78 Fed., 811; C. C. E. D. Pa., DALLAS, C. J.; *Hanifen v. Price*, 96 Fed., 435, 440; C. C. S. D. N. Y., TOWNSEND, then D. J.; *Welsbach Light Co. v. American Incandescent Lamp Co.*, 98 Fed., 613, 616; C. C. A., Second Circuit, WALLACE and SHIPMAN, C. Js., opinion by SHIPMAN.

These decisions are summed up in Walker on Patents, 4th Edition, page 66, as follows:

> "When a patent is questioned in point of novelty, and when that question depends upon the date of the invention claimed in that patent, it is not material whether the event, which constituted that invention, occurred in the United States or in some other country."

Judge Bradford's Decision.

The very recent opinion of Judge BRADFORD referred to at the beginning of this brief, was filed after this brief was substantially completed. It is of such importance as to merit separate consideration in its relation to the various subjects involved in the case at bar. Full copies of this opinion will be handed to the Court. The suit is that of Minerals Separation Ltd., one of the complainants here, against Miami Copper Company. It was commenced after the decision of the Circuit Court of Appeals of the Ninth Circuit which is here for review, and the defendant relied largely upon that decision, but Judge BRADFORD reached conclusions wholly contrary to those of the Ninth Circuit Court of Appeals, and having been advised at the trial that this Court had issued its writ of *certiorari*, does not refer to that decision in his opinion.

The infringement complained of was the treatment of a copper ore without acid and without heat and, in one instance, with an oil other than oleic acid, and, in two other instances, with a mixture of such an oil and a soluble frothing agent, so that the claims involved of the patent here in suit were only the broader claims—those not limited to the use of acid, or to the use of heat, or to the use of the oil oleic acid—to wit: claims 1, 9 and 12. These three claims are also here involved. Judge BRADFORD gave careful consideration to every prior document referred to in the opinion here under review (and two additional documents) and reached the conclusion that the invention here involved was novel and patentable, and he adjudged claims 1 and 12 valid and entitled to "much liberality of construction" (Judge BRADFORD'S decision, p. 43) and adjudged that they were infringed. As to claim 9 he held that it was "so indefinite as to render the claim void" (p. 41). In that particular we contend that he erred in the application of the law as to the liberal construction of patent claims. Except in this respect his conclusions and the reasons given therefor are wholly consistent with those above stated in this brief.

The invention. Judge BRADFORD had before him for adjudication three of the patents of complainant Minerals Separation, Ltd.

The first patent there in suit was the patent here in suit.

The second patent there in suit was for the later discovery that certain substances not oils and not immiscible in water, but to the contrary wholly soluble in water, were capable of effecting a similar modifying action in the pulp and a similar air bubble and froth-forming action, and of producing under suitable agitation and aeration a substantially similar air-froth flotation-separation of metal particles from gangue as the minute quantity of oil effects and produces in the process of the patent here in suit.

The third patent there in suit was for an improvement upon the second patent there in suit, involving the treatment of copper ores with a particular class of soluble frothing agents, namely, aromatic hydroxy compounds, without heat and without acid; the omission of heat and the omission of acid having been discovered to be in this combination positively beneficial; and it may be noted in passing that Judge BRADFORD in his discussion of anticipation of this latter highly useful invention by the second patent there in suit appears to have confused the disclosure of the specification of the second patent with the scope of the claims of that patent, thereby treating a patent when it is set up as an anticipation as though it actually disclosed everything that might subsequently be held, for the purposes of a question of infringement, to be within the scope of the claims.

As to these three patents Judge BRADFORD says:

> "In each the agitation of the pulp coupled with the introduction of air into it develops and distributes throughout the mixture small bubbles of air which attach themselves to the metallic particles, to the exclusion of gangue; and rise with them and form a metallic air froth on the surface, readily removable therefrom, the gangue particles sinking to the bottom and being disposed of as refuse" *(idem*, p. 3).

Further as to the first patent there in suit, the patent here in suit, Judge BRADFORD says that it is

> "an air flotation process, in which, owing to the use of a frothing agent in conjunction with such agitation of the ore pulp as will distribute the metallic particles of the ore throughout the mixture and produce bubbles of

air and bring them in contact in the mixture with the metallic particles so distributed, the bubbles will become attached to such metallic particles, carrying them separate from the particles of gangue up through the surface of the mixture where they can readily be collected by skimming, overflow, or the use of other well known devices. In this process the frothing agent consists of an oil or other immiscible substance or material of an oily nature, and the bubbles and metallic particles become attached to each other through affinity between the bubbles and the metallic particles enhanced by the coating of the latter with an extremely thin film of oil" (*idem*, p. 7).

The question of invention. Judge BRADFORD had before him by stipulation the identical London evidence which was taken in the case at bar, with omission only of the matters personal to the defendant Hyde. His conclusions, therefore, from the facts and circumstances connected with the discovery of the process here in suit, were founded upon the record in that respect which is before this Court. He also had before him all prior documents referred to in the opinion of the Circuit Court of Appeals in the case at bar, and also two prior documents not in evidence in the case at bar. His consideration of the question of invention commences at page 10 of his opinion. He says, in part:

> "There was, I think, patentable invention in the discovery thus made in March, 1905. Prior to that time there had been no suggestion in the art that the proportion of .1% of oil to ore or of any other fraction of 1% of oil to ore would or might result in successful concentration. Further, the result reached was an utter surprise. Experiments were conducted with reference to the Cattermole process, and all of the Cattermole patents required the formation and sinking of granules containing the metallic particles, and not their flotation. The teaching of that process was that the metallic particles should go to the bottom and that of the process of the first patent in suit that they should go to the top" (*idem.*, p. 14).

And further he says:

> "The defendant lays much stress upon the proposition that the reduction of the amount of oil in the

process for the concentration of ore did not and could not involve patentable invention, but only an ascertainment of the proper *degree* in which oil should be used, which was readily discoverable by any one competent to conduct or superintend a process of ore concentration; and further, that motives of *economy* would naturally have suggested a reduction in the quantity of oil to the extent of its excess over what was necessary for the accomplishment of the purposes of the process. *But if such a reduction was obvious, why is it that it was never made prior to the discovery in question? The fact that economy required the use of the least quantity of oil sufficient for the conduct of the process affords cogent evidence that the feasibility of effecting a reduction was not obvious, but properly the subject of patentable invention.* No one to-day understands how the use of only .1 per cent. of oil operates to secure the mineral froth of the first patent in suit. This is testified to by the experts and is admitted on both sides. If the principle of operation of the discovery is insolvable to the human mind to-day, it could not have been predicted or anticipated by the human mind in March, 1905" (*idem*, p. 15; italics ours).

Judge Bradford then cites *Diamond Rubber Co. v. Consolidated Tire Co.*, *supra*, 220 U. S., 428, and quotes the statement therein of this Court to the effect that a patentee may be "baldly empirical, seeing nothing beyond his experiments and the result," yet if he has added something new and valuable "to the world's utilities, he is entitled to the rank and protection of an inventor."

Judge BRADFORD further says:

> "This case is unlike those in which the discovery of the use of an element in a process in the degree insuring the best results is a matter within the competency of those skilled in the art, but, on the contrary, is one where *clearly there was patentable invention or discovery in ascertaining the degree.* The experiments made with respect to the Cattermole process were initiated with a view to its improvement and the securing of granulation of a higher efficiency. The prosecution of the experiments relating to a sinking and not a floating process would naturally tend to divert the mind from the contemplation of any process of the latter character" (*idem*, p. 16; italics ours).

Judge BRADFORD then quotes the testimony of Mr. Higgins as to the research work prior to the discovery where, whenever the granulation became imperfect by reason of the drop in the quantity of oil, the oil was naturally increased.

Judge BRADFORD then further says :

> " *I perceive no escape from the conclusion that the discovery was patentable.* To decrease the amount of oil used in an old process, so long as the characteristic mode of operation and result of such process are preserved, even though in less degree, does not as a general rule involve invention. *But when the old mode of operation and its result through a decrease in the amount of oil disappear and a new and different result is disclosed the change ceases to be one of mere degree, and may support a patent monopoly in favor of one whose inventive genius or research has discovered the process.* The patentability of the process of the first patent in suit resides in the use of only the minute quantity of oil contemplated by the patent. The reduction of the oil to this quantity effected a change, not merely in the degree, but in the ' type of oiling ', leading to results which cannot be accounted for on the assumption that a mere change in degree as distinguished from patentable discovery was involved " (*idem*, p. 17 ; italics ours).

Judge BRADFORD then notes that the evidence before him satisfactorily proves that as to the process here in suit

> " depending upon the selective affinity of the air-bubbles in the mixture for oil-coated metallic particles, that affinity is strongest when the film of oil surrounding the metallic particles is so thin as to be imperceptible to the senses, and that with any substantial increase in the quantity of oil on the metallic particles the character of the process is changed and its efficiency diminished for some reason as yet unrevealed " (*idem*, p. 17).

The evidence in the case at bar, including the admissions of defendant's foreman, is to the same effect.

Judge BRADFORD says (*idem*, p. 14) :

> " But while the ascertainment that such a minute proportion of oil would effect a successful concentration

> of ore through a flotation process was a discovery, it was nevertheless of such a character, viewed with respect to the circumstances under which it was made, as to involve invention and confer patentability. The statutes provide for patenting new and useful inventions and discoveries, but a bare discovery unaccompanied by the exercise of any invention in reaching it or utilizing or reducing it to practice would not justify or support a monopoly in the discovery. In the present case, however, the facts disclose not a bare discovery, but a discovery coupled with invention in usefully applying it. In such cases patents properly may be granted."

This is equally true and is established by the same evidence in the case at bar.

The discovery in the case at bar was not the sort of discovery as to which this Court said in *O'Reilly v. Morse*, 15 Howard, 61, 116:

> " the discovery of a principle in natural philosophy or physical science, is not patentable."

In the case at bar the principle in physical science involved has not really been discovered to this day. Rather in the case at bar was the discovery a discovery that a certain definite and valuable result followed a certain definite and practicable procedure. And that procedure constitutes the invention.

As was quoted with approval by this Court in *LeRoy v. Tatham*, 22 Howard, 132:

> "'There can be no patent for a principle; but for a principle so far embodied and connected with corporeal substances as to be in a condition to act and to produce effects in any trade, mystery, or manual occupation, there may be a patent.'"

The discovery in the case at bar is like that referred to by this Court in the *Telephone cases*, 126 U. S., 1 (p. 532):

> " In this art—or, what is the same thing under the patent law, this process, by way of transmitting speech—electricity, one of the forces of nature, is employed; but electricity, left to itself, will not do what

is wanted. The art consists in so controlling the force as to make it accomplish the purpose. It had long been believed that if the vibrations of air caused by the voice in speaking could be reproduced at a distance by means of electricity, the speech itself would be reproduced and understood. How to do it was the question.

"Bell discovered that it could be done by gradually changing the intensity of a continuous electric current, so as to make it correspond exactly to the changes in the density of the air caused by the sound of the voice. This was his art. He then devised a way in which these changes of intensity could be made and speech actually transmitted. Thus his art was put in a condition for practical use.

"In doing this, both discovery and invention, in the popular sense of those terms, were involved; discovery in finding the art, and invention in devising the means of making it useful. For such discoveries and such inventions the law has given the discoverer and inventor the right to a patent—as discoverer, for the useful art, process, method of doing a thing he has found; and as inventor, for the means he has devised to make his discovery one of actual value."

Claim 9. It will be noted that although Judge BRADFORD finds that the process is dependent on the extreme tenuity of the film of oil on the metallic particles and that the selective action is due to the air bubbles and that the process is "an air flotation process," he nevertheless limits the breadth of the claims to the carrying on of the procedure with the employment *in the pulp* of a fraction of one per cent. of oil on the weight of the ore. The essence of the invention, as he points out above, is that the metal particles shall be coated with a film "so thin as to be imperceptible to the senses." It is conceivable that this may happen with a larger proportion of oil in the mixture of oil, water and ore than a fraction of one per cent. of the ore, as in the examples above stated in this brief where claim 9 of the patent in suit is considered (*supra*, p. 55), as where a peculiar gangue might uselessly absorb within its pores a portion of the oil, or where the oil or mixture of oils might have unusual characteristics. For example two oils might be used one of which would coat the mineral with an attenuated film imperceptible to the senses such as the process requires and effect the result of the process, and the other

conceivably perform some other useful function, or be wholly useless and neutral and be used merely to justify the statement that in the aggregate more than a fraction of one per cent. of oil has been added to the mixture. It is against such possibilities, any of which might well arise within the life of the patent in the efforts of infringers to use the invention and avoid the wording of the claims, that the patentees are entitled to claims 9, 10 and 11, and we contend that in this respect (though in this respect only) Judge BRADFORD erroneously applied the law to the facts of the case. His discussion of claim 9 (*idem*, pp. 41, 42) presents his views on this question.

Judge BRADFORD says in substance that claims 1 and 12 " are definite, specifying and limiting the amount of oil to be used ", whereas claim 9 in specifying " a small quantity of oil " is " so indefinite as to render the claim void " ; this conclusion being based on the assumption that if claim 9, like claims 1 and 12 be by construction " so limited as to be restricted to the use of oil, the amount being only a fraction of one per cent. on the ore, that claim is in substance * * * the same as claim 1." Apparently Judge BRADFORD would by construction have so limited claim 9 had it been the only claim in the patent.

Claim 9, we submit (as well as claims 10 and 11, where the same language is employed), should be construed to save them rather than to destroy them (*ut res magis valeat quam pereat. Corning v. Burden*, 15 How., 269), in spite of the presence of other claims. Limiting words (as of degree) in a claim should be construed in the light of the disclosure made in the specification and in the light of the real invention (*Carnegie Steel Co. v. Cambria Iron Co.*, 185 U. S., 403, 432. Robinson on Patents, Vol. II., p. 507, Sec. 751). So construed, claims 9, 10 and 11 would be limited to that small quantity of oil which is described in the specification and which would in use develop the operation and effect described and would embody the invention. To interpret the term " small " in these claims loosely enough and broadly enough to bring in and cover and include processes of the prior art which do not involve the real invention, would be contrary to established canons of interpretation repeatedly laid down and applied by this Court. Similarly to hold that the word " small " in this connection is so indefinite that the claims in question are void, would be contrary to es-

tablished canons of interpretation repeatedly stated and applied by this Court. "Small" in this connection means small on a scale on which everything in the prior art was large, small in the sense in which the proportions set out in the specification are small, small in a sense that will in fact produce the operations and effects described.

Whether or not the phrase "a small quantity of oil," which is found in claims 9, 10 and 11, would in a proper case be given a slightly broader interpretation than the phrase "a fraction of one per cent. of oil on the ore" found in other claims, is a question that does not arise in the case at bar, for defendant in the case at bar employed an amount of oil that was at once "a small quantity of oil" and at the same time "a fraction of one per cent. of oil on the ore." Such a question is really a question of construction and scope of claims that does not arise here and is not material here, although it may arise and become material on some future question of infringement—but the question need not be prejudged here (*Carnegie Steel Co. v. Cambria Iron Co., supra*). The claims in question would not necessarily be identical with claims 1 and 12, as Judge BRADFORD seemed to think. That again would be a question of construction which does not arise here. Claims 9, 10 and 11 are capable of a construction which distinguishes them from the prior art and which is limited to the real invention and which is infringed by defendant's process. They should therefore be sustained, leaving to future litigation possible refinements of distinction in scope between them and other claims if future developments of the art make such distinctions material or important. No harm can be done to any one by that course. Unknown harm might be done to Petitioner by the opposite course.

A specific example of what has been the practice of this Court in sustaining claims for valuable inventions by limiting them to the real invention of the patentee, appears in *Klein v. Russell*, 19 Wallace (86 U. S.), 433, wherein Mr. Justice SWAYNE, delivering the opinion of this Court, said (pp. 465, 466):

> "The claims are as follows:
> "1. The employment of fat liquor in the treatment of leather, substantially as specified.
> * * * * * *

"The first claim, it has been argued, is for use of fat liquor generally, hot or cold. If it be for the former only, the patent may be valid: while, if for the latter, it may be too broad and, therefore, void.

"The counsel for the patentee insists that the claim is limited to fat liquor in a heated state. The subject is to be examined in the light of both specifications and of both sets of claims. The court should proceed in a liberal spirit, so as to sustain the patent and the construction claimed by the patentee himself, if this can be done consistently with the language which he has employed.

* * * * * *

"We think the better opinion is, that the first claim was intended to cover, and does cover, only the use of heated liquor."

A specific example of an unexpected and wasteful consumption of material has already occurred in the use of the invention in the concentration of San Francisco del Oro ore at Swansea, Wales (*supra*, pp. 81, 82), where the consumption of sulphuric acid was greatly in excess of what was required for the necessary physical action of the sulphuric acid, because of the presence in the ore of a large percentage of limestone or calcite which wasted the sulphuric acid in useless chemical action, itself neither harmful nor beneficial to the process.

Haynes British patent. As to this patent Judge BRADFORD says:

"I am satisfied that the Haynes patent is not an anticipation, and, equally, that as part of the prior art it cannot operate to negative invention. In the first place, aside from all other features, the patent does not limit the quantity of oil, fatty or oleaginous matter to the oil proportions of the first patent in suit, and, secondly, the patent does not require agitation of the pulp other than such as may result from the passage of the same into a 'triturating machine'" (*idem*, p. 23).

In conclusion as to this patent Judge BRADFORD quotes the exact description of the extent and nature of the Haynes disclosure, which appears in the judgment of the Privy Council (*idem*, p. 24).

Everson patent. Judge BRADFORD calls attention to the fact that this patent specifies two methods of conducting the

process, requiring in the first method 5 per cent. of oil, and in the second method 16 per cent. to 17 per cent. of oil (*idem*, p. 26). He does not particularly describe these two methods, but says:

> "*I am not satisfied by any experiment or demonstration made in the case that the process described in the Everson patent would produce the economical and efficient concentration secured by the process of the first patent in suit.* Certainly, were there nothing else, a reduction in the quantity of oil from 17% or even 5% to a fraction of 1% on the weight of the ore, under circumstances similar to those attending the discovery of the sufficiency of that minute proportion for successful metallurgical operations would be sufficient to confer patentability" (*idem*, p. 27; italics ours).

It may be said here that the same counsel who argued the appeal at San Francisco in the case at bar, and skillful metallurgical manipulators, one of whom conducted the courtroom experiments there, were permitted by Judge BRADFORD to exhaust their ingenuity in conducting experiments at a long trial in open court with the experimenters on the stand and subject to cross-examination, and with the constituents and the products of the experiments subject to chemical analysis by opposing parties, and Judge BRADFORD's conclusions may well therefore be set over against those of the Circuit Court of Appeals in the case at bar as to the Haynes, Everson, Froment, Kirby, Schwarz and Cattermole patents and the patents in suit, where that Court said:

> "The evidence in the case, together with the illustration thereof afforded by demonstrations of the various processes which were made in the aid of the argument before this Court, convince us that the froth in all these processes is the same, with the exception that there is less oil (as there must necessarily be) in the appellees' froth than in the others. The froths are all similar in appearance, they all rise to the surface after the same amount of agitation, *they all gather with equal efficiency the same amount of metal*, and all may be removed from the surface in the same way" (R., pp. 720, 721; italics ours).

Fryer Hill Publication and Oriley and Everson Publication. As to these Judge BRADFORD says :

> " Neither of these articles contains anything rendering it necessary to add to what has been said in direct connection with the Everson process " (Judge BRADFORD'S decision, p. 27).

Elmore patents. Judge BRADFORD considers these patents very fully and quotes from the House of Lords' and the Privy Council judgments as to comparisons of this process with the process in suit (*idem*, pp. 18–23), and in conclusion says :

> " It is too clear for further discussion that the bulk oil Elmore process in no way affects the validity of the first patent in suit " (*idem*, p. 23).

Judge BRADFORD also considers in connection with the Everson patent the erroneous argument (applied by the Circuit Court of Appeals in the case at bar to all of the prior art except Elmore), that those patents which disclose less oil than Elmore could not have relied at all on oil-buoyancy flotation, and dismisses it with his criticism of the defendant's experiments (*idem*, pp. 26, 27).

Cattermole patents. Judge BRADFORD gives very full consideration to these patents, as is warranted by their importance in the history of the art and in the making of the discovery and invention in suit. He properly disposes of the contention that the Cattermole proportions as applied to a lean ore would approximate those of the process in suit, by a reference to the warning in the specification that the process is dependent upon a certain nucleating or granulating action which is insufficient with a lean ore and therefore that a lean ore must first be enriched or have added to it material that will become coated with oil. He says of this contention of the defendant :

> " This contention ignores the following statement in the description of the Cattermole patent now considered " (*idem*, p. 29),

and then quotes from the specification of Cattermole patent No. 777,273 the warning in question, and very fully explains its meaning, saying :

> "It is evident that the weight of 'pulverized mineral matter' introduced to 'maintain the necessary amount of mineral in the ore under treatment' is, for the purpose of determining the necessary amount of oil, to be added to 'the weight of metalliferous mineral matter present in the ore.' Such must be the meaning of the patent or it is insensible. And this accords with the requirement in the seventh claim of 'adding particles of material having an affinity for oil to assist in the formation of granules of oil-coated particles.' *The defendant has made no demonstration, as might have been done, of the amount of oil required by the Cattermole process in its application to lean copper ores, but indulges in speculation and conjecture on that point*" (*idem*, pp. 29, 30 ; italics ours).

It will be seen that the facts proved were exactly parallel to those in the case at bar. Here also the defendant indulges only in speculation and conjecture and founds thereon the argument which was adopted by the Circuit Court of Appeals with the effect of reading from the Cattermole specification a disclosure of oil proportions approximating those of the process here in suit.

It is submitted that the conclusion which Judge BRADFORD reached upon the case before him is the only reasonable conclusion which can be reached upon the substantially similar evidence in the case at bar, a conclusion directly contrary to that of the Circuit Court of Appeals.

Another argument put forth by the Circuit Court of Appeals in the case at bar with the effect of reading from the Cattermole specification a disclosure of a froth flotation process, was founded upon the practice of two-stage agitation which had grown up in the investigations of that Cattermole process. This is very fully considered by Judge BRADFORD (*idem*, pp. pp. 30, 31). Judge BRADFORD says :

> "On the assumption that two degrees of agitation were required in the Cattermole process ; first, violent agitation of the mixture in order to bring the oil into intimate contact with the mineral particles ; and, sec-

ondly, the subjection of the mixture to a slower or rolling form of agitation to cause the agglomeration of the oiled metalliferous particles and the formation of granules, it by no means follows that with the omission of the second step the mineral froth of the process of the first patent in suit would have been formed, had there been in the mixture oil in excess of the proportions contemplated by that patent. And if be further assumed that the mixture containing oil and other elements in Cattermole proportions can first be violently agitated so as to produce a froth and then slowly agitated so as to produce granules, and again violently agitated so as to destroy the granules and restore the froth, and so on by alternation, and that, the mixture remaining the same, the production of froth on the one hand, or granules on the other, is simply a matter of manipulation, it is not to be inferred that the froth so formed with Cattermole proportions of oil would be the froth of the first patent in suit" (*idem*, p. 30).

Judge BRADFORD then refers to two experiments wherein with 3.6% of oil Cattermole granules were formed and sunk, and with .1% of oil and identity as to all other conditions mineral froth was formed and floated. But this was merely a repetition of the experiments proved by documentary evidence in the case at bar as made at the time of the discovery of the process in suit.

In conclusion Judge BRADFORD says:

> "The description of the patent nowhere specifies that its process is necessarily dependent upon two degrees of agitation, one violent and the other slow or rolling, and in none of the seven claims of the patent, with the exception of the fifth, is such a requirement mentioned or suggested. In that claim only is there a provision for 'further agitating the mass to increase the size of the granules,' and even in that claim there is no suggestion of a difference in degree between such further agitation and the agitation which has preceded it" (*idem*, p. 31).

It will be noted that Judge BRADFORD does not mention the clear disclosure in the Cattermole patent of separation in an upcast following the first agitation and preceding the second agitation, which of necessity would carry upward and away with the sand and gangue any metallic particles which even

tended to float. This but confirms the conclusion Judge BRADFORD reached.

In conclusion Judge BRADFORD says :

> " For the foregoing reasons I think that the contention of the defendant that the quantity or proportion of oil used in the Cattermole process was not materially in excess of that used in the process of the first patent in suit, and that, not a difference in the quantity of oil, but a resort to two degrees of agitation was essential to the formation of Cattermole granules, cannot be sustained " (*idem*, p. 31).

Sulman and Picard Patent. To this patent No. 793,808 Judge BRADFORD gave careful attention (*idem*, pp. 34–37), and he quotes quite fully from the specification the description of the first and second methods disclosed therein, which are the only methods disclosed therein wherein an effort is made to utilize the buoyancy of air or gas bubbles. It may be noted that the defence of non-infringement relied strongly upon this patent, asserting that the defendant's process was that of this patent carried on in improved apparatus (*idem*, pp. 42–47). Judge BRADFORD says :

> " This process patent, issued to Sulman and Picard upon an application filed October 5, 1903, *affords cogent circumstantial evidence of the patentability of the process of the first patent in suit.* I have been unable to read the description of the patent immediately under consideration without reaching three conclusions; first, that Sulman and Picard had conceived an idea, though imperfect, of an air flotation of the metallic particles; secondly, that they had no conception whatever of the possibility of conducting such a process with the minute quantity of oil specified in the first patent in suit; and thirdly, that they contemplated the the use of a very much larger proportion of oil. In view of the fact that both patentees in No. 793,808 were two of the three patentees of the process of the first patent in suit, it is so improbable as to amount to a moral impossibility that for nearly a year and a half after the filing of the application for patent No. 793,808 they should have devoted their attention and efforts to the solution of the problem of the proper quantity or proportion of oil to be used in securing improved

granulation in the Cattermole process, and have been astonished at the making of the discovery in March, 1905, if they had recognized or believed that an economical and efficient process of ore concentration could be carried on by the use of oil amounting to only a fraction of one per cent. Any further discussion of patent No. 793,808, I think, is unnecessary" *(idem*, pp. 36, 37, italics ours).

Froment Patents. Judge BRADFORD considers the Froment Italian and British patents and quotes from the specification of the Italian patent, and then says:

> "The weight of the evidence is that the quantity of oil to ore necessary for the conduct of the process specified in the patent would amount to from 12% to 15% of the weight of the ore, and this seems to accord with the statements in the patent that a 'kind of metallic magma' is formed and that 'the metallic spherules pressed one against the other, will become grouped in a magma clearly separated from the remainder of the liquid.' These statements, I think, are inconsistent with any idea that under the Froment process the metallic particles were coated with oil of the extreme thinness characterizing the process of the first patent in suit" (*idem*, p. 32)

Judge BRADFORD then refers to scientific evidence as to the extreme thinness characterizing oil coatings of the process in suit, which evidence is not before this Court, although it is an interesting scientific fact that an oil film one one-hundred-thousandth part of an inch in thickness is capable of being produced upon a metallic particle, and is capable of exercising in the process in suit the remarkable quality of increasing the attraction and adhesiveness of an air-bubble and the metal particles so coated, when a thicker coating would impair or destroy that attraction for, and adhesiveness to, air-bubbles. Judge BRADFORD then says:

> "The British Froment patent is in substance the same as the Italian patent and in neither of them does it appear that there was present in the Froment process the very minute quantity of oil of the first patent in suit (*idem*, p. 33).

Froment description. As to the disclosures of this document, Judge BRADFORD says:

> "The instructions recommend the use of oil in proportions varying from 1% to 3½% according to the different percentages of metal in the ore. Notwithstanding the low percentage of oil mentioned in the Froment description, I have reached a conclusion that it contained no disclosure of the process of the first patent in suit. The evidence on the subject of the Froment description is voluminous and conflicting, but there are facts and circumstances which have satisfied me that the process of the first patent in suit was not discoverable from that description by men skilled in the art of ore concentration" (*idem*, p. 33).

And further Judge BRADFORD says:

> "There is uncontradicted evidence that Sulman, Picard and Ballot, after the assignment of the Froment British patent and the receipt of the Froment description and instructions, made persistent efforts to operate the Froment process successfully, but only met with failure, and that the model apparatus sent by Froment to Ballot was treated as worthless and discarded or 'scrapped.' Sulman, Picard and Ballot were scientific men of large experience in the art of ore concentration, and had the Froment patents or description disclosed or suggested the process of the first patent in suit, it is to be assumed that they would have utilized it instead of prolonging their attempt until March, 1905, to perfect granulation under the Cattermole process. *The fact that they did not utilize it affords the strongest evidence that the Froment description did not suggest a process in which the minute quantity of oil required by the first patent in suit could be successfully used in ore concentration*" (*idem.*, p. 34; italics ours).

The evidence upon which Judge BRADFORD expressed this opinion is the testimony taken in London in the case at bar and thereafter stipulated into the suit before Judge BRADFORD.

Schwarz patents. Judge BRADFORD considers the Schwarz patents here in evidence, rejects 807,501 as too late even in the filing of its application, and carefully considers 807,503, which was held by the Circuit Court of Appeals in the case at bar to disclose a process substantially the same as, and equally efficient with, the process of the patent here in suit. Judge

BRADFORD's first comment is as to the abandonment by defendant's counsel of any effort to prove in his Court what the Court of Appeals of the Ninth Circuit deemed to have been proved in the case at bar. Judge BRADFORD says :

> "Although offered and admitted in evidence, no testimony has been adduced by the defendant in explanation of any of them, nor have counsel for the defendant made any argument in support of them" (*idem*, p. 25).

As to 807,502 and 807,503, Judge BRADFORD says :

> "Evidently each of them requires the use of a larger quantity of oil than the minute proportion required by the first patent in suit; * * * (and 807,503 states) that 'the ore is mixed with sufficient of the selective material to make a thick, pasty mass, the agitation being continued long enough to bring the selective material into intimate contact with all portions of the ore,' and 'the mass is then allowed to subside, when the selective material, with the entrapped metallic constituents of the ore, will rise to the top,' etc. There is, I think, no evidence or legitimate inference to warrant the conclusion that either of these patents can affect the validity of the first patent in suit" (*idem*, pp. 25, 26; parenthetical insertion ours).

It will be noted that Judge BRADFORD treated the Schwarz application as though it were a prior patent and part of the prior art. He did the same as to the Kirby patent next to be considered. This was, we submit, error of law, arising from a conflict of adjudication, but this gave to these documents their maximum force and effect.

Kirby patents. These patents are thoroughly considered (*idem*, pp. 24, 25). Judge BRADFORD says :

> "The process patent recommends from 25 per cent. to 75 per cent. of oil to the ore, stating that 'preferably the pulverized ore is mixed with 3 to 5 times as much water, by weight, and to this is added a sufficient amount of the kerosene-bitumen solution, excellent results being attained by using one-fourth to three-fourths as much by weight as ore.' *It is fair to assume that Kirby would not have specified oil to the extent of from 25 per cent. to 75 per cent. on the weight of the ore had he deemed it*

practicable to do with less. An examination of the process patent and of the evidence relating to it shows, I think, that the patents contemplated an *oil buoyancy* flotation in contradistinction to the metallic air froth of the first patent in suit, and was for a different process, not suggestive of that of the latter, with its economical and successful use of a fraction of one per cent. of oil. The Kirby apparatus patent No. 838,626 is for a separating-tank intended for use in the Kirby process. In view of what has been said touching that process the apparatus patent does not call for discussion" (*idem*, pp. 24, 25; italics ours).

Water Concentration. Judge BRADFORD very fully explains this standard concentration process of the art (*idem*, p. 2) and the great difficulty which arose in that process in the loss of metal in the slimes which were necessarily produced in grinding the particles so small as to free the metallic particles from the gangue particles (*idem*, pp. 7, 8).

Slimes. In considering the advantages of the process here in suit Judge BRADFORD says:

> "A great advance in the art of ore concentration has resulted from the process of the first patent in suit in the efficient recovery of slimes. With the use of that process ore may be so finely ground as to insure the thorough separation of the metal particles and gangue, and great saving is effected" (*idem*, p. 18).

He then gives an example which was proved before him of such an annual saving in the output of the principal porphyry copper mines, estimated at $17,000,000. This particular example is not before the Court in the case at bar, but the evidence in the case at bar as to the Australian dumps at Broken Hill of some eleven million tons of material, part of which is pure slime, and all the reject of other processes, and now largely changed into valuable metal by the process here in suit, is a similar example.

Court Room Experiments. Judge BRADFORD comments, as he was well qualified to do after the long trial before him, upon the experiments which accompanied the trial. He says:

> "During the trial a large number of experiments were made for the purpose of illustrating ore concentra-

tion processes described in patents and other printed publications of the prior art. Such experiments are illuminating and helpful, or deceptive and misleading, according to the conditions under which they are performed. As a general rule, in such experiments the processes of the prior art should be illustrated by means of appa-atus of the prior art in which such processes were conducted at or about the time of invention and under the conditions then understood and observed. To construct apparatus long after, and in view of subsequently acquired knowledge, in order to show a prior process tends to produce embarrassment and confusion touching the nature and operation of the process inquired into" (*idem*, p. 39).

After citing well known authorities above quoted in this brief Judge BRADFORD says :

> "The material question for the Court is not whether any given apparatus is capable, under manipulation employed in view of existing knowledge, of carrying on the prior process inquired into, but whether the process was carried on as part of the prior art, and, in case of an ore concentration process, by way of illustration, under what conditions as to ingredients, strength and extent of agitation and other essential factors ; and only so far as those conditions are reproduced and faithfully observed in demonstrations in Court, due allowance being made for the difference in the requirements of mill operations is the experiment entitled to probative force" (*idem*, p. 40).

Had these sound views prevailed in the Circuit Court of Appeals for the Ninth Circuit in the consideration of the case at bar, that Court would not have been misled by the experiments alleged to represent prior disclosures testified to in behalf of the defendant in the case at bar, every one of which comes within the definition given by Judge BRADFORD of misleading and deceptive experiments. As for the experiments made in Court at the time of the argument and not sworn to by any witness, they should have had no more effect than the "gesture of counsel," to repeat an expression applied thereto by one of defendant's counsel at the trial before Judge BRADFORD.

It is submitted that the decree of the Circuit Court of Appeals should be reversed, and a decree directed affirming that of the District Court.

Very respectfully,

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New York, N. Y., October 18, 1916.

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SUPREME COURT OF THE UNITED STATES

OCTOBER TERM, A. D. 1916.

No. 46.

MINERALS SEPARATION, LIMITED, AND MINERALS SEPARATION AMERICAN SYNDICATE, LIMITED, PETITIONERS,

vs.

JAMES M. HYDE, RESPONDENT.

BRIEF FOR RESPONDENT.

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JAMES M. HYDE, RESPONDENT.

BRIEF FOR RESPONDENT.

In discussing the matters at issue we have first explained the subject-matter in suit and have referred to the various prior art processes sufficiently to show anticipation of the process set forth in the patent in suit. This part of the brief extends from pages 1 to 102. The detailed consideration of the prior art processes begins upon page 102. The general arrangement of the brief is indicated in the synopsis upon the preceding pages.

The Proceedings in the Courts Below.

Petitioners, Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, on October 3, 1911, filed a bill in equity against James M. Hyde, respondent, in the United States District Court, District of Montana, Northern Division, charging infringement of United States patent No. 835,120, and praying for an injunction and an award of profits and damages.

The case was argued in the District Court before Judge Bourquin, whose opinion (Transcript, page 18) was filed on July 28, 1913. Judge Bourquin found the patent in suit valid and infringed. A decree (Transcript, page 25) in accordance with the opinion was entered August 15, 1913, and an injunction (Transcript, page 27) was issued, and served upon respondent October 25, 1913 (Transcript, page 28), since which date the injunction has remained in force restraining respondent from the practice of his profession in connection with the process which the patent in suit purports to cover.

Respondent's appeal from the decree of the District Court was allowed September 8, 1913 (Transcript, page 37). The assignment of errors appears at page 28 of the Transcript. The first eleven assignments related to the findings of the court upon the question of validity of the patent and infringement, the issuance of an injunction, recovery of profits and damages, reference to a Master, and recovery of costs. Discussion of the subjects of validity and infringement forms the principal subject-matter of this brief. The twelfth, thirteenth and fourteenth assignments of error related to the apparent exclusion by the District Court of certain testimony, but, as subsequently explained by the Court, the testimony referred to was not ruled out.

The appeal was argued February 19 and 20, 1914, in the Circuit Court of Appeals for the Ninth Circuit, before Judges Gilbert, Ross, and Dietrich. The opinion of the court, written by Judge Gilbert, was filed May 4, 1914 (Transcript, pages 715-723), and for reasons stated in the opinion the decree of the court below was reversed, and the cause remanded with instructions to dismiss the bill.

A petition for rehearing (Transcript, page 725) was filed June 1, 1914, and denied July 6, 1914 (Transcript, page 757), on which day, upon motion of counsel for petitioners, the issuance of the mandate was stayed for sixty days. (Transcript, page 757.)

Thereupon petitioners filed in this Court a petition for a writ of certiorari addressed to the Judges of the Court of Appeals, which petition was granted, thereby bringing the case before this Court.

BRIEF OF ARGUMENT.

Subject-Matter in Suit.—Concentration of Ores.

The patent in suit—United States patent No. 835,120 (reproduced at page 475 of the Transcript)—relates to a process of concentrating ores. Concentration is the separation of an ore into two parts, one part consisting principally of worthless material, which is rejected, and the other part containing a high proportion of the valuable metalliferous mineral. While all of the constituents of an ore are mineral, some of the witnesses have followed the usage common in mining parlance of referring to the metalliferous mineral in the ore as "mineral"—that is, they have used the word mineral to designate the desired mineral. The worthless mineral in an ore is

known as gangue, and after the valuable metalliferous mineral has been separated from the gangue the latter is rejected and known as the tailing.

Of course the ideal concentration would be the separation of the ore into two parts, one part consisting entirely of worthless matter and the other consisting entirely of the valuable matter. Such an ideal separation, however, is not possible. The tailings, which are rejected, always contain some of the valuable material, and the concentrate always contains more or less of the worthless gangue.

Smelting.

Metals rarely occur as free or native metal in nature, but generally in chemical combination as oxides, carbonates, sulphides or other chemical compounds. The process of concentration has nothing to do with the separation of the free metal from the chemical compound in which it occurs in nature. Concentration merely effects the more or less perfect separation of the chemical compound containing the metal from the other constituents of the ore. The freeing of the metal from the chemical compound in which it occurs is accomplished by smelting in furnaces or by chemical or electro-chemical methods. These latter operations are not involved in this suit. The patent in suit relates solely to the concentrating operation.

Operations Involved in Concentration of Ores.

The valuable metalliferous minerals generally occur in minute particles disseminated through and embedded in rock. In order to separate the metalliferous mineral from the worthless rock (commonly known as gangue) it is necessary that the rock be pulverized to a degree

of fineness sufficient to free the particles of metalliferous mineral from the rock in which they are embedded. After the rock is so pulverized it becomes necessary to separate the minute metalliferous particles from the gangue particles with which they are intimately mixed. The patent here in suit relates to a process for effecting this separation.

The crushing and fine grinding of ores for the purpose above mentioned is effected by various means, the particular means selected depending upon the character of the ore, the degree of fineness to which it is necessary to crush it, and other considerations. The initial crushing may be effected by an ordinary rock or ore crusher, and after the ore has been crushed to a certain degree of fineness it is mixed with water and subjected to grinding operations in mills of various types. The product resulting from the final grinding in water is known as "pulp" or "ore pulp." This pulp contains such an amount of water that it flows freely like muddy water, and in the treatment of an ore pulp for the removal of the valuable metalliferous particles the pulp is handled in this freely flowing condition, being conducted from place to place through troughs, known generally as launders, and being subjected to the action of a wide variety of appliances designed to cause certain constituents of the ore to settle and thus separate from the remaining constituents which remain in suspension or float and flow away.

Flotation Concentration.

It has long been known that when oil or oily matter is added to an ore pulp and the resulting mixture of ore, water and oil is agitated or stirred and then brought to rest, the valuable metalliferous parts of the ore will float on top of the mixture, and the worthless rock particles will sink. Removal of the floating material by permitting it to overflow or by skimming it off affords means for separating the valuable metalliferous portion of the ore from the gangue.

While we have used the term "oil or oily matter," there is a great variety of substances other than oils that will effect the result above described, but there is no generic term to include all such substances. Coal tar, wood tar, derivatives of wood and coal tar, such as phenol and cresol, and a wide variety of fats and oils, are suitable for the purpose. The patent in suit mentions the fact that a variety of substances are suitable for the purpose (Transcript, page 475, second paragraph). A similar statement occurs in patent No. 793,808 (Transcript, page 659, second paragraph), in Cattermole patent No. 777,273 (Transcript, page 647, second paragraph), in Haynes British patent No. 488 of 1860 (Transcript, page 523), and in other patents. Oleic acid may be used for the purpose. While this substance is chemically an organic acid it is what is ordinarly known as an oil, and its virtue is supposed to reside in its oily properties and not in the fact that it is chemically an acid. We will in this brief follow the usage of the art and for want of a better term will refer to all of this wide variety of substances as "oils."

The separation of the valuable metalliferous particles from the gangue particles by flotation is not perfect.

The floating layer, while containing a large proportion of the valuable metalliferous particles, also contains more or less of the gangue, and the mass which sinks to the bottom carries with it more or less of the valuable metalliferous mineral, but the ratio of valuable metalliferous particles to gangue particles is higher in the floating mass than in the original ore. The part of the metalliferous matter which is not recovered in the concentrate and which remains with the bulk of the worthless rock or gangue is lost, and this rejected residue, consisting mostly of gangue but carrying a certain proportion of valuable mineral, is known in the art as the "tailing." Oftentimes the tailings resulting from one operation are treated again, either by the same or a different method, for the purpose of recovering some of the valuable mineral not recovered in the first operation. The material to be treated in a concentration operation is frequently referred to as the "heads," and the tailings of one operation may become the heads of a succeeding operation, designed, as above indicated, to recover some of the valuable material lost in the first operation.

Use of Acid in Flotation.

It has also been known for many years that the addition of a small amount of acid, such as sulphuric acid, to the mixture of ore, water, and oil has the effect in the case of some ores of increasing the efficiency of the operation, that is, the effect of causing a larger proportion of the valuable metalliferous mineral to find its way into the floating mass.

Three Types or Classes of Flotation.

All flotation processes fall into one of three distinct classes: (1) The Elmore bulk oil or oil buoyancy flotation process; (2) the surface tension or film or skin flotation process; and (3) the gas-oil flotation process.

The process described in the patent in suit belongs to the third class, wherein the flotation is due to the buoyancy of bubbles of air or other gas. In the Elmore bulk oil process the flotation is effected by the buoyancy of the oil itself, and special precautions are taken to avoid the introduction of bubbles of air. Below we explain the three classes of flotation quite fully, for the reason that in the courts below petitioners endeavored to make it appear that the prior art processes upon which respondent depends as anticipations are of the Elmore bulk oil type. An understanding of the three types of flotation makes it manifest that the prior art processes are, like the process of the patent in suit, oil-gas processes of the third class, and could by no possibility be bulk oil flotation processes of the first class.

Elmore Bulk Oil or Oil Buoyancy Flotation.

The Elmore process is described in United States patents No. 676,679 and No. 689,070 (Transcript, pages 608 and 612), as stated by Mr. Ballantyne, a witness for Minerals Separation, Limited. (Transcript, page 213, folio 429.)

From the description appearing in the two United States Elmore patents referred to and from the testimony of witnesses for Minerals Separation, Limited, it appears that the Elmore process depends for its operativeness upon the fact that when a large amount of a thick oil is added

to an ore pulp and the pulp is very gently agitated the metallic particles in the ore will adhere to and be entrapped in the thick oil, while the worthless rock particles will remain in suspension in the water. The floating layer of thick oil containing the entrapped metalliferous particles may then be drawn off from the underlying water, thus effecting the desired separation of valuable from worthless particles. A general description of the Elmore bulk oil process is given by Dr. Liebmann, one of the expert witnesses for Minerals Separation, Limited, as follows:

> "The Francis Elmore patent No. 676,679 issued June 18, 1901, discloses a process of separating minerals from gangue by oil flotation. It depends on the fact that by immersing the ore in oil, only the minerals are taken up by the oil if water be present, and the gangue remains behind. That is the broad principle.
>
> . . . . . .
>
> "The process depends on flotation by specific gravity. The pulp, which ought to be a freely flowing mixture, has a quantity of oil added and has to be agitated by slowly revolving agitation in such manner that the oil does not break into small globules. The minerals will be enclosed by the oil and the oil will float by buoyancy. This process depends on the well-known fact that you can reduce the specific gravity of a heavy substance by mixing with a light one." (Transcript, page 258.)

Conditions Essential for Elmore Bulk Oil Flotation.

There are several conditions all of which must exist in order that the Elmore process may operate:

(*a*) *The oil must be of lower specific gravity than water,* that is, it must be lighter than water, otherwise the metalliferous mineral entrapped in the oil would not be floated and thus separated from the worthless

rock particles. Dr. Liebmann makes this clear in the passage above quoted. In United States patent No. 676,679 (Transcript, page 609, near top of page) Elmore says that "the metallic particles will adhere to the oil and be buoyed up and floated by it, while the other constituents of the ore will remain in the water."

(*b*) *The oil must be thick or viscous,* otherwise the mineral particles would drop out of the floating layer of oil instead of remaining entrapped therein, and in order that this viscous condition of the oil may be preserved *heat must be avoided,* as heat renders oils thinner or less viscous. The necessity of using a thick, viscous oil is referred to in Elmore's United States patent No. 676,679 (Transcript, page 608), where the patentee refers to the use of "the heavier oils" and says that he has found "the 'residuum' of mineral oil after the more volatile elements have been distilled off" to be suitable. In the same patent (Transcript, page 609, bottom of page) the patentee Elmore refers to the use of "thick oil." The necessity of using a thick or viscous oil is dwelt upon at length by several of the witnesses who testified for Minerals Separation, Limited. The testimony of these witnesses in connection with this and other characteristics of the Elmore process is quoted on pages 12 to 20 of this brief.

(*c*) *In the Elmore bulk oil process it is necessary that a very large amount of oil be used,* an amount equal to about three times the weight of the ore treated. Elmore in his United States patents does not specifically name the amount of oil other than in his statement (patent 676,679, Transcript, page 609, top of page) that "the metallic particles will adhere to the oil and be buoyed up and floated by it," thus showing that the amount of oil must be such that its buoyancy will be sufficient to float the metallic particles. In the Elmore

patent 689,070 (Transcript, page 612) a similar statement appears, namely, that "the oil, with most of the metallic substances entrapped in it, floats at the top." As a matter of fact, the amount of oil necessary is, as above stated, from one to three times the weight of the ore being treated, as will appear from the testimony of witnesses for Minerals Separation, Limited, quoted upon pages 12 to 20 of this brief.

(*d*) *In the Elmore bulk oil process the mixture of ore, water and thick oil must be agitated very gently,* and anything in the nature of brisk or violent agitation must be avoided. The reason for this is that violent agitation would break the oil up into small particles or globules, which would be disseminated through the mass of ore and water, thus forming an intimate mixture of water, ore particles, and minute oil globules, which mixture would prevent any separation whatever of the metallic particles from the worthless rock particles. Such a mixture has been referred to by witnesses for Minerals Separation, Limited, as a "frog's spawn" effect, and the same witnesses have likened such a mixture to "mayonnaise dressing." Violent agitation would have the further effect, deleterious to the Elmore bulk oil process, of introducing air bubbles. The necessity of agitating the mixture gently is pointed out by Elmore in his United States patent No. 676,679, in which he directs the operator to "agitate the mixture without breaking up the oil into small globules" (Transcript, page 609, near top of page). The testimony of witnesses for Minerals Separation, Limited, explaining the necessity of avoiding violent agitation in the Elmore process appears at pages 12 to 20 of this brief.

(*e*) *Aeration must be avoided.*

Testimony Descriptive of Elmore Bulk Oil Flotation.

The following are quotations from the testimony of employees of and witnesses for Minerals Separation, Limited, in which the witnesses describe the four essential characteristics of the Elmore process set forth above.

HENRY L. SULMAN.

Mr. Sulman is one of the grantees of the patent in suit (Transcript, page 127). He testified as follows:

> "Relative to the Elmore and Wolf processes, both of these processes were bulk oil processes, which depended upon the buoyancy of the oil for supporting the mineral entrapped in it. Considerable viscosity of the oil is necessary to prevent the heavy mineral from sinking out of the oily mass too rapidly when so entrapped. The Wolf process involved the use of oil made still more viscous by the use of chloride of sulphur. In both these processes increased temperature led at once to decrease in viscosity and considerably enhanced the tendency of the entrapped mineral to fall out of the bulk of oil in which it had been entrapped.
>
> "In the Wolf and Elmore bulk oil processes, if agitation exceeded a certain moderate limit, the oil became emulsified in the pulp and a mass of heterogeneous material was formed in which oil, water, mineral and gangue were contained as a 'mush.' Such of this material might float, whilst other portions would sink; no separation of mineral from gangue would be effected, and with violent agitation the whole mass would form an emulsified product which might be likened to a salad dressing of the mayonnaise variety, but containing ore." (Transcript, page 146.)

GEORGE A. CHAPMAN.

Mr. Chapman is a metallurgical engineer in employ of Minerals Separation, Limited (Transcript, page 181). He testifies as follows:

"In the tests made by me of the Elmore bulk oil process and heretofore referred to by me, the proportion of oil relatively to the ore varied according to the ore being tested. I used a minimum equal weights of oil and ore, and as a maximum the oil three times the weight of the ore. We did everything we possibly could to make the mixture of (354-277) the ore pulp and oil to be of a most gentle type, and it was our aim to avoid any breaking up of the oil. No aeration took place.

Cross-Examination.

"These experiments in connection with the Elmore bulk oil process were carried out by me under instructions of Messrs. Sulman and Picard, and were tipping tests on various samples of ore in a glass cylinder.

"I took a glass cylinder that would hold 1200 cc. of water and in this placed 100 grammes of crushed ore. To the ore would be added 600 to 800 cc. of water. Upon this would be placed 100 grammes of thick residuum oil. The stopper would be placed in the cylinder and the cylinder was then gently tipped or revolved in a vertical direction. I would exercise great care not to break up the oil which would bring about a frog's spawn effect. After about thirty tips, that is to say fifteen vertical revolutions of the cylinder, I would let the water pulp settle. I would then draw off the oil by means of a spatula and transfer this to a basin. An examination of the tailings would show whether a good recovery of the sulphide content had been obtained. If this showed the presence of sulphide mineral I added a further 100 grammes of oil and resumed the tipping. After another thirty tips I would stop the test and draw the oil off as before. If necessary this would be carried out three times." (Transcript, page 197.)

WILLIAM H. BALLANTYNE.

Mr. Ballantyne is a chemist and engineer and patent agent (Transcript, page 212), who has acted for Messrs. Sulman, Picard & Ballot, grantees of the patent in suit, since 1902 (Transcript, page 214, near bottom of page). He testifies as follows:

> "I first saw the Elmore bulk oil flotation process tested in the latter part of 1902 and I have many times since then tried the Elmore processes under different conditions and with different ores. These processes are set forth in United States patents Nos. 676,679 and 689,070, the latter differing from the earlier one only in that it describes the use of an acidified ore pulp as distinguished from a neutral ore pulp described in the earlier patent. It is essential to these processes that the oil should be thick and viscous. I have frequently tried thin oils, such as oleic acid, in the Elmore processes, but they do not operate as the vicosity of the oil is not sufficient to retain or entrap the metalliferous sulphides, which easily fall out of the oil. It is also essential for the same reason that the Elmore processes shall be carried out in the cold, because if the oil is heated it becomes thin and will not entrap nor float the sulphide mineral. In the tests of the Elmore processes it was always essential that the mingling of the pulp and the oil should be as gentle as possible, so as to avoid the inclusion of globules of water in the oil, and to avoid breaking up the oil into globules, because when the oil included water or when the oil was broken up, gangue was floated with the oil. I have tested the Elmore process, using vigorous agitation, and the whole pulp was brought into an emulsion like mayonnaise, full of ore, and this emulsion would not separate, after standing for months." (Transcript, page 213.)

Dr. Adolf Liebmann.

Dr. Liebmann was an expert witness for Minerals Separation, Limited. He testified as follows:

> "The Francis Elmore patent No. 676,679, issued June 18, 1901, discloses a process of separating minerals from gangue by oil flotation. It depends on the fact that by immersing the ore in oil, only the minerals are taken up by the oil if water be present, and the gangue remains behind. That is the broad principle. . . . The process depends on flotation by specific gravity. The pulp, which ought to be a freely flowing mixture, has a quantity of oil added and has to be agitated by slowly revolving agitation in such manner that the oil does not break into small globules. The minerals will be enclosed by the oil and the oil will float by buoyancy. This process depends on the well-known fact that you can reduce the specific gravity of a heavy substance by mixing with a light one." (Transcript, page 258.)

In discussing United States patent No. 793,808, this being one of the numerous flotation patents in the record, Dr. Liebmann in defining the amount of oil to be used according to the process of patent No. 793,808, made reference to the amount of oil necessary for the Elmore bulk oil process as appears from the following quotation:

> "The quantities of oil to be used in the different processes of this patent are within a very wide range, but the fundamental condition is that the solid particles shall be 'moistened' by the oil (Spec., page 1, line 19). That is the lower limit. The upper limit is that the patentees do not desire buoyancy flotation or, as they express it, 'in quantity insufficient to raise the oiled mineral by virtue of the flotation power of the oil alone' (Spec., page 1, lines 25-27). This means that the quantity of oil must be less than is required to make the mixture of oil and minerals of lighter specific gravity than water. Of course, the quantity of oil necessary for such purposes is not a constant; it depends on the quantity of the minerals

present and their character and specific gravity, but, roughly speaking, it always will require for average ore oil in quantity about three times the weight of ore, that is, about 6000 lbs. of oil to the short ton of ore." (Transcript, page 273.)

Dr. Liebmann also testified as follows:

"The two Elmore patents depend on oil buoyancy flotation pure and simple, and they differ from each other that in the one no acid is present, whilst in the other one an acid is present. Only heavy oils are used. The extraction of the ore with oil is repeated so often until the tailings are clean. The quantity of oil used in these processes is roughly three tons of oil to one ton of ore treated, assuming an ore such as Broken Hill ore is treated. A large quantity of this oil is recovered by centrifugal separation." (Transcript, page 330.)

DR. CHANDLER.

Dr. Chandler was an expert witness for Minerals Separation, Limited. In describing the Elmore bulk oil process he refers to several of Elmore's United States patents. The particular form of the apparatus described in these patents is not important in the present connection, and in quoting the following passages from Dr. Chandler's testimony we invite attention merely to the emphasis which he lays upon the essential characteristics of the Elmore bulk oil process enumerated above. Dr. Chandler testified as follows:

"Elmore Patent No. 653,340 of 1900 [Transcript, page 605].—This patent, though put in evidence by defendant, was not explained by any of defendant's witnesses.

"The general type of mixing device here disclosed has received some consideration in the testimony for complainants.

"The apparatus of the patent was particularly designed to gently mix ore pulp and oil so as to avoid aeration. The patentee says:

" 'The ore and water and oil which are thus mingled without being broken up so as to form a uniform mixture' (Spec. 653,340, page 1, lines 54-57). [Transcript, page 606, near top of page.]

"The uniform mixture here referred to as something to be avoided, is an emulsion, such as would result from violent agitation, and which, with the large quantities of oil used in this apparatus, would defeat the object of the process in which the apparatus is to be used, to-wit: the flotation of the valuable mineral of an ore by oil buoyancy.

"The apparatus also includes a centrifugal separator for recovering oil from the oil-floated concentrates. From this centrifugal (*h*, Fig. 2), the separated oil is drawn up through the pipe *c* to the cistern *o*, in which a partial vacuum is created so as to remove any air bubbles which may have become incorporated in the oil. Some slight aeration might result from the action of the centrifugal separator. The patentee says:

" 'In order to clear the oil from air-bubbles, I prefer to draw the oil up to the cistern by creating a partial vacuum in the cistern' (Spec. 653,340, page 1, lines 88-91). [Transcript, page 606, below middle of page.]

"It is also suggested that instead of employing centrifugal force to separate the oil from the oil-floated concentrates, the oil may be separated by first heating it (654-576) or thinning it with benzoline and allowing the concentrate to subside, or subjecting it to filter pressing. It is notable that the oil which is to be used is a very thick and viscous oil, compared to which oleic acid is a very thin oil. The oil is described as follows:

" 'The thick oil which I employ is the thick tarry residue usually called "residuum" of mineral oil after some of the more volatile constituents have been distilled off' (Spec. 653,340, page 1, lines 24-28). [Transcript, page 605.]

"This, therefore, is an apparatus for oiling a pulp with great quantities of oil so as to avoid aeration, for recovering so much of the oil as practicable from the

concentrate, and for removing any bubbles of air which may possibly have become commingled with the oil.

"Obviously, the apparatus is entirely unsuitable for briskly agitating and aerating an ore pulp, such as is necessary for the purpose of the patent in suit.

"Elmore patent No. 692,643 of 1902 [Transcript, page 615].—This patent discloses another variety of mixing apparatus for use in the Elmore bulk oil process. This patent also was put in evidence by the defendant, but was not explained by defendant's witnesses.

"The apparatus consists of a trough, through which extends a horizontal shaft carrying screw-propeller blades which act to mix the oil and pulp, and propel it toward the exit end of the apparatus. The description of the apparatus is very brief. The patentee says:

> " 'As the liquid mineral pulp and oil are caused by the blades *c* to travel along the trough *a* they become thoroughly mixed, and the mixture issues by an opening *f* into a subsidence tank *g*.' (Spec. 692,643, page 1, lines 25-29.) [Transcript, page 615.]

"I also refer to the companion patent No. 689,070 [Transcript, page 612] for a description of the operation.

. . . . . .

"This corresponding process patent No. 689,070 merely adds to the earlier process patent the use of acid.

"It clearly states the function of the oil to entrap and float the mineral. The apparatus is, therefore, designed to mix, not to aerate, and is well adapted to mix a great quantity of oil with an ore pulp, and distribute the oil in contact with the valuable mineral, so that the mineral will be entrapped and floated by the oil in the next or subsidence vessel. For this purpose, the blades should be revolved at a comparatively slow speed. High speed would defeat the object of the apparatus. The apparatus is a good mixer when aeration is not desired, and when considerable quantities of oil are used. It

would be an entirely inefficient device if an attempt were made to use it for the purposes of the patent in suit." (Transcript, pages 360-361.)

Following is another passage from Dr. Chandler's testimony:

"(*b*) Pulp Treated with Oil; Concentrates Separated from Surface.—1 and 2. Elmore patents No. 676,679, of June 18, 1901, and No. 689,070 of December 17, 1901.—The second of these patents differs from the first only in that acid is added to the ore pulp.

"Both are bulk oil flotation processes in which a great quantity of oil is used, which acts to entrap the mineral and float it to the surface by reason of the fact that the specific gravity of the mixture of oil and mineral is less than that of water.

"Brisk agitation must be avoided because it would tend to make a uniform mixture or emulsion, which would prevent the separation. An effort is made to save some of the oil by treatment in a centrifugal machine or by a filter press, and the recovered oil is treated to an air withdrawing operation, so as to remove any air bubbles that may possibly have gotten into the oil.

"Dr. Byrnes very properly says of the four Elmore patents, two for apparatus and two for processes, all of which I have considered, that they

'relate to the flotation of mineral by oil *per se* rather than gas.'

And also that

'The flotation processes described therein do not rely on aeration or the evolution of a gas.'

"It is in evidence that these Elmore processes were tried in practice and long since abandoned, and this I can well understand, since the loss of oil, with all the efforts made to recover it, would be very much greater than the amount of oil used in the process of the patent in suit.

"I have made several tests of the Elmore process. The amount of oil with Broken Hill ore required for carrying on the process would be about

6000 lbs. of oil for a short ton of ore." (Transcript, page 368.)

Dr. Chandler also made the following statement:

". . . we have the Elmore oil buoyancy flotation process, in which the mineral was made so light by entrapping it in great quantities of oil that the mixture of oil and mineral became lighter than water and floated." (Transcript, page 382, middle of page.)

Surface Tension, Film, or Skin Flotation.

Many attempts have been made to effect the separation of the valuable metalliferous parts of ore from the gangue particles in an ore pulp by utilizing the phenomenon generally known as "surface tension flotation," "film flotation," or "skin flotation." It has long been known that minute particles of solid matter heavier than water will float upon the surface of water if gently deposited thereon. A film of dust particles floating on the surface of a pool of water and causing the surface to have a dull appearance is a familiar sight. No very satisfactory explanation of the fact that small particles of solid matter heavier than water will float upon the surface of water has been advanced by the witnesses. It has been said that the surface of the water acts as though covered with a film or skin of infinitesimal thickness, and that particles of solid matter will not sink unless of sufficient weight to rupture the covering skin or film. However, this is a metaphor and not an explanation.

Mr. Sulman, one of the grantees of the patent in suit, makes the following statement regarding surface tension or film flotation:

"By film flotation, which is also referred to by us as skin flotation, is meant the flotation of particles of

oiled or unoiled mineral at a water surface by surface tension effect. Such films would contain the mineral particles in a *layer, not substantially exceeding one particle thick.* Both oiled and unoiled mineral particles form such films, but the films of oiled mineral are much more persistent than films which are composed of unoiled particles. Such films may occasionally contain isolated bubbles coated (260-184) with, or contaminated by, such mineral particles, but such occasional bubbles would not form a froth." (Transcript, page 145.) (Italics ours.)

Mr. Ballantyne, an expert witness for Minerals Separation, Limited, discussed the subject of surface tension or film flotation as follows:

". . . Messrs. Sulman, Picard and Ballot, without knowing of Bradford's process, worked out a process on the same lines, which is described in British patent No. 5,260 of 1905, which patent is now abandoned. This process, which was briefly described as skin flotation without oil, was given a very thorough trial in 1905, 1906, and the early part of 1907, because in so far as the process involved the use of no oil or other agents, an economy in this direction might have been effected if the process had been a success. However, it is only very rarely that an ore will give anything like a reasonable separation by such a method. The process is not applicable to slimes, *and as the floating particles are in the form of a film, or in patches one particle thick, the area of the separating surface has to be very large,* and there is great difficulty in keeping it sufficiently still to allow of any skin flotation. Unfortunately, also, some gangue materials are floated by skin flotation as readily as associated mineral." (Transcript, page 225.) (Italics ours.)

Having in mind the extreme fineness to which ore is ground for concentration, it will be apparent that a layer one particle thick, the thickness of the layer defined by Messrs. Sulman and Ballantyne in the passages above quoted, is a very minute amount, and, as stated by Mr.

Ballantyne, the recovery of any appreciable amount of material by such a method would require exceedingly large water surfaces.

Gas-Oil Flotation.

It was known long prior to the date of the patent in suit that agitation of an ore pulp with much smaller quantities of oil—quantities insufficient to float the mineral by the buoyancy of the oil—would cause the oiled metalliferous mineral to float. An examination of a floating mass of mineral produced by agitation with an amount of oil too small to float the mineral by the buoyancy of the oil would at once reveal the cause of the flotation. Such floats are permeated with air bubbles, the bubbles being coated more or less completely with mineral particles. In the various processes antecedent to the alleged invention of the patent in suit oil was used in quantities ranging from 1 per cent. or less to 75 per cent., by weight, relative to the ore treated.

Process Described in Patent in Suit is a Gas-Oil Process.

The process described in the patent in suit is of the gas-oil variety, the flotation being effected in the form of a froth or scum containing air bubbles. The particular point of novelty claimed for the process of the patent in suit is the use in such a process of an amount of oil weighing less than 1 per cent. of the weight of the ore treated.

Respondent contends that the use of less than 1 per cent. of oil involves nothing but economy, and that the process of the patent in suit is identical with all of the prior art processes in which the ore pulp is agitated with an amount of oil too small to produce the Elmore bulk

oil flotation effect and in which the inevitable result of the agitation is to produce a floating froth or scum permeated with and composed of air bubbles.

Comparison of Three Types of Flotation.

No other form of flotation than the three types above described is referred to in this record, and no other form of flotation is known to exist. All metalliferous particles are heavier than water. If such particles are found floating on the surface of water the flotation must be due to one of the three causes above set forth, viz., (1) the metalliferous particles may be entrapped in a mass of thick oil which has sufficient buoyancy to float the metalliferous particles by reason of the oil acting as a boat or raft, from one to three tons of oil per ton of ore being necessary for this purpose; or (2) the metalliferous particles may float as a result of the phenomenon variously known as surface tension flotation, film flotation or skin flotation, which method is characterized by the flotation of a very minute amount of mineral particles as a layer not exceeding one particle thick; or (3) the flotation may be due to the inclusion of bubbles of air or other gas in the floating mass, the air or gas bubbles imparting the buoyancy necessary to flotation.

In considering the prior art processes to which we shall refer more in detail hereinafter there will be no difficulty in ascertaining the type of flotation utilized. For bulk oil or oil buoyancy flotation of the Elmore type from one to three tons of oil are necessary for a ton of ore; if less oil is used, or if the oil has not the viscosity necessary for the Elmore process, or if the mixture is so violently agitated as to defeat the Elmore process, then the flotation must be of either the second or third type, viz., surface tension flotation or gas-bubble flotation. If the

floating mass does not consist of a mere film of particles not substantially over one particle thick, the phenomenon cannot be of the surface tension or film flotation type. If the floating mass is of substantial thickness and permeated with bubbles of air or other gas, and less than the Elmore amount of oil has been used, the flotation must be of the bubble type—that is, due to the inclusion of air or bubbles of other gas which impart the necessary buoyancy.

The Patent in Suit.

The patent in suit appears at page 475 of the Transcript. The part of the specification contained in the second paragraph on page 477 and that part of the specification extending from the eleventh line on page 478 to the end of the specification relate to methods and apparatus for recovering that part of the metalliferous mineral which is not recovered by the process to which the claims of the patent are directed.

The object and nature of the process of the patent in suit is set forth in the second paragraph of the specification thereof in the following words:

> "This invention relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue." (Transcript, page 475.)

In the last paragraph on page 475, the specification refers to "the oil-coated metalliferous matter," and the last two paragraphs on page 476 contain references to the coating of the metalliferous mineral with oil—oleic acid being referred to as the oil used. Claims 1, 2, 3 and

4 (Transcript, page 479) specify "an oily liquid having a preferential affinity for metalliferous matter," and claims 9, 10, 11 and 12 specify the step of "coating the mineral with oil in water."

The passages above quoted show that the patent in suit is plainly and unequivocally based upon the theory that the "preferential affinity" of oily matter for the metalliferous mineral is the underlying cause of flotation.

Reference to Cattermole Process.

The third paragraph of the specification of the patent in suit (Transcript, page 475) is to the effect that in the process described in a previous United States patent, No. 777,273, granted to A. E. Cattermole,

> "an amount of oil varying from four per cent. to six per cent. of the weight of metalliferous matter present is agitated with an ore pulp, so as to form granules which can be separated from the gangue."

The patentees also make the following statement:

> "if the proportion of oily substance be considerably reduced—say to a fraction of one per cent. on the ore—granulation ceases to take place, and after vigorous agitation there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum.

Dr. Chandler, expert witness for Minerals Separation, Limited, characterizes the foregoing statement as "the foundation of the invention described and claimed in this patent." (Transcript, page 51, top of page.)

The patent also contains the following:

> . . ." (Transcript, page 475, last paragraph.)
> "When agitation is stopped, a large proportion of the mineral present rises to the surface in the form of a froth or scum which has derived its power of flotation mainly from the inclusion of air-bubbles

introduced into the mass by the agitation." (Transcript, page 476, next to last paragraph.)

Inasmuch as the specification of the patent in suit is based upon references to the Cattermole patents, and inasmuch as the patentees explain their process by reference to the difference between their process and the Cattermole process, it becomes necessary at this point to understand what the Cattermole process is.

The Cattermole Process.

The Cattermole process is not a flotation process, and in this respect is different from every other concentration process in which oil or oily substances are used. The process described in the Cattermole patents is a method of using oil to increase the sinking tendency of the metalliferous mineral.

Cattermole patent 777,273 (Transcript, page 647) contains a statement that the invention covered thereby is an improvement in ore concentration,

> "by means of the selective action of oils and certain tar products or similar compounds (all hereinafter referred to as 'oil') on metallic or metalliferous matter," (Transcript, page 647, second paragraph) and that " . . . *if the proportion of oil is kept within reasonably low limits* (differing in different cases, according to the nature of the mineral to be treated and the consistency and nature of the oil) and if the mixture of water, oil, metalliferous particles, and gangue be thoroughly agitated the metalliferous particles which have become coated with oil will adhere together and form granules" (Transcript, page 647, last six lines) "the granules, with a certain amount of heavy sands, sink to the bottom and are discharged through a pipe G^1 into the vessel A^5, while the lighter sands are carried away by the upward current." (Transcript, page 649, near top of page.) ". . . Usually an amount of oil vary-

ing from four per cent. to six per cent. of the weight of metalliferous mineral matter present in the ore yields granules of suitable size, consistency, and specific gravity for ready separation from the gangue." (Transcript, page 649, near bottom of page.) (Italics ours.)

Cattermole patent 777,274 contains a description similar to that above abridged from patent 777,273.

Amount of Oil Used by Cattermole.

It will be noted that Cattermole referred to oil amounting to from 4 to 6 per cent. of the weight of metalliferous mineral matter in the ore as conforming to his instruction that the quantity of oil be "kept within reasonably low limits." Prior to Cattermole's idea of using oil to promote the sinking of the metalliferous mineral, oil had been used only to cause flotation of the metalliferous mineral, and in this state of the art Cattermole did not regard 4 to 6 per cent. of the metalliferous mineral by weight as an exceptionally small quantity of oil, but merely as a "reasonably low limit."

Cattermole's 4 to 6 per cent. of the weight of the metalliferous mineral in the ore, in the case of an ore containing 12 per cent. of metalliferous matter, such as zinc sulphide or blende, or any other metallic compound, would be from 0.48 per cent. to 0.72 per cent. of oil to the entire ore. Both of these amounts are within the limits named in the patent in suit, namely, a fraction of 1 per cent. of the weight of the ore. In fact, Cattermole's maximum amount of oil, 6 per cent. on the metalliferous mineral in the ore, would amount to only 0.96 per cent. of the ore in the case of an ore containing 16 per cent. of metalliferous mineral, and Cattermole's minimum percentage of oil, namely, 4 per cent. of the metalliferous

mineral contained in the ore, would amount to only 0.96 per cent. in the case of an ore containing 24 per cent. of metalliferous mineral. It thus appears that the Cattermole patents recommend for ores containing as high as 24 per cent. of metalliferous mineral a quantinty of oil which amounts to less than 1 per cent. of the weight of the ore, *i. e.*, a quantity identical with that named in the patent in suit, less than 1 per cent., of the weight of the ore.

It therefore conclusively appears from the face of the documents that there is no difference in the amount of oil recommended by Cattermole and that directed in the patent in suit.

Two-Stage Agitation in Cattermole Process.

The evidence conclusively establishes the fact that the formation of the granules or pellets in the Cattermole process did not arise from the particular quantity of oil used, but from a unique two-stage agitation—the *first stage,* a violent agitation to distribute the oil and cause it to coat the metalliferous particles; and the *second stage,* a slow, smooth stirring of the ore pulp to cause the oiled metalliferous particles to agglomerate, stick together, and form granules or pellets of sufficient size to have a distinct tendency to sink as compared with the unoiled and unagglomerated gangue particles. The Cattermole patent 777,273 makes reference to this second stage of slow, smooth stirring, and complainants' metallurgists and experts have testified that this two-stage agitation is absolutely essential to the Cattermole process. We quote the following from Cattermole's patent No. 777,273:

> ". . . With certain ores it may be preferable to use in some stages of the process a rolling form

of agitation, as in cylinders or barrels, to obtain good granulation of the mineral." (Cattermole patent, Transcript, page 651, lines 11-14.)

The absolute necessity of the two-stage agitation to produce the Cattermole sinking granule effect is conclusively shown by the testimony of Messrs. Sulman, Chapman and Ballantyne, Sulman being one of the grantees of the patent in suit, and the others being expert witnesses for Minerals Separation, Limited.

In their testimony referred to below Messrs. Sulman, Chapman and Ballantyne refer to the use of "baffles" in the agitating apparatus. The agitating apparatus referred to by them is what they term a "cone mixer" or "Gabbett," Gabbett being the name of the inventor of the apparatus. The apparatus is described and illustrated in the Gabbett United States patent No. 444,345, appearing at page 481 of the Transcript, the illustration appearing just preceding page 481. The apparatus is also illustrated and described in Gabbett's British patent (Transcript, page 527), and in certain advertisements which are in evidence and reproduced on the three pages just preceding page 557 of the Transcript. From the patents and advertisements referred to, and from the testimony of the witnesses quoted below, it appears that the cone mixer or Gabbett consists of a containing vessel in which a hollow conical stirrer is rapidly rotated. If the containing vessel is cylindrical, certain obstructions or baffles are formed on the inside of the circular wall of the vessel which render the agitation more violent by interfering with the smooth rotating movement that would otherwise be communicated to the material by the rotation of the hollow cone. When such a smooth rotating movement of the material is desired, it appears from the testimony of the witnesses

quoted below that the baffles are taken out of the circular vessel.

Mr. Henry L. Sulman, one of the grantees of the patent in suit, testified as follows regarding the character of the agitation and the effect of the projecting ribs or baffles in the apparatus when used in the Cattermole process:

> ". . . *Such baffles were invariably used during the first part of the Cattermole granulation* where it was necessary to agitate the oil and the mineral to the extent required to uniformly coat the mineral particles with oil. *The baffles were not used in the second portion of the Cattermole process* where it was desirable to roll these oiled particles into granules. *The use of baffles would have been inimical to the carrying out of the second stage of the Cattermole process,* as in this stage the use of baffles would have prevented the building up of the shot-like granules in the Cattermole process, *but the baffles assist the operation of the process of patent 835,120 in suit at all stages,* inasmuch as the baffles produced the violent agitation and the entraining of air necessary to float mineral as a froth when quantities of oil were used insufficient for granulation." (Transcript, page 141.) (Italics ours.)

Mr. George A. Chapman, testifying for complainants, stated that the apparatus used to carry out the Cattermole process consisted of a series of Gabbett or cone mixers, which were six in number for the first agitation. He then described the operation as follows:

> ". . . *This first agitation was of a very violent type* to bring about the oiling of the sulphide mineral. The agitated pulp was then passed to a small glass upcast separator where the fine gangue slimes were washed from the pulp, allowing only the oiled metalliferous particles and the coarse gangue to pass to the *second stage* of the process, which consisted of slowly rolling in the same type of mixer as used in the first stage, but *with the baffles taken out*

and the speed of the cone much reduced. This slow rolling had the effect of causing the incipient granules to make combination amongst themselves, and the rolling was continued until the mineral worked into the form of hard shotty granules. *In the second stage of the process it was highly important to prevent air attaching itself to the mineral, and this was the reason for taking the baffles out and reducing the speed."* (Transcript, page 184, folio 369.) (Italics ours.)

Complainants' witness Ballantyne (Transcript, page 214, folio 431, and page 231, X-Q. 42) testified to precisely the same effect.

In the Cattermole operations in Australia, as stated by Chapman, there were two sets of agitators, one set with baffles, and a second set without baffles for the "slow rolling," in which second set the agitators "were much reduced in speed." (Transcript, pages 185, 186, folios 372, 373.)

Patent in Suit Erroneously Directs Same Kind of Agitation for Flotation as for the Cattermole Process.

With regard to the agitation mentioned in the patent in suit, the patentees state (patent 835,120, Transcript, page 476, about the middle of the page) that the mixture

". . . is briskly agitated in a cone-mixer or the like, as in the processes previously cited [*i. e.*, the Cattermole process] for about two and one-half to ten minutes, until the oleic acid has been brought into efficient contact with all the mineral particles in the pulp."

This statement in the patent in suit that the mixture is agitated as in the Cattermole process is obviously incorrect. The kind of agitation used in the Cattermole process would never produce a floating concentrate, but would produce the Cattermole sinking granules. Mr.

Sulman and Mr. Chapman, in the passages above quoted from their testimony, explicitly state that one kind of agitation is necessary for the Cattermole process and another kind for the process of the patent in suit; Sulman says that the baffles that are necessary in all stages of the agitation for the process of the patent in suit would be inimical to carrying out the second stage of the Cattermole agitation, and Chapman says that in the Cattermole second stage it is highly important to prevent air attaching itself to the mineral, and that this is the reason for taking out the baffles and reducing the speed of agitation in the second stage of the Cattermole agitation.

Patent in Suit Erroneously Gives Cause of Flotation as Use of Less Oil Than Used by Cattermole.

Minerals Separation, Limited, in the language employed in the patent in suit and in the testimony of their employees and officials, seeks to make it appear that the only difference in procedure between the Cattermole process and the process of the patent in suit is in the smaller amount of oil used in the latter process, and in furtherance of this idea the patent in suit contains the above quoted statement that the mixture is agitated "as in the process previously cited," *i. e.*, as in the Cattermole process. But the record refutes this contention. Sulman and Chapman on the witness stand had to admit the truth, namely, that a radical difference in the character of the agitation is the distinguishing feature; and as above set forth (*supra,* page 27) the amounts of oil directed in the Cattermole patent and in the patent in suit are practically the same.

Agitation Employed in Process of Patent in Suit is Simply the Old Agitation of the Prior Art.

As a matter of fact, the agitation employed in the process of the patent in suit is simply the ordinary agitation described in the prior art, and the Cattermole effect is due to an original and peculiar form of two-stage agitation.

The patent in suit contains not a word or suggestion relative to any extraordinarily violent agitation, but, on the contrary, the patent in suit erroneously recommends agitation of the kind used in the Cattermole process.

Furthermore, as will appear in the subsequent discussion of the prior art patents, publications, and documents with which the grantees of the patent in suit were familiar before the date of their alleged invention, these patents, publications and documents contain language descriptive of agitation as violent, or more violent than that indicated by the patent in suit.

The patent in suit further defines the degree of agitation by stating that it is continued until the oil "has been brought into efficient contact with all the mineral particles in the pulp" (Transcript, page 476, just below middle of page), and complainants' witness Sulman, one of the joint patentees in the patent in suit, has testified to the obvious truth that "The first requisite of any oil concentration process is to obtain efficient contact between the oil and the mineral . . ." (Transcript, page 129, folio 257.) So far as this expression is concerned, the patent in suit plainly recommends only the kind of agitation previously in use and essential to any and all of the prior oil concentration processes, and hence if air is beaten into the pulp as a result of the agitation recommended in the patent in suit, then air was likewise beaten into the pulp in all prior oil concentration processes.

The fact that no especially violent character of agitation is described or recommended in the patent in suit is further shown by the fact that neither the drawing nor the specification of the patent contains the slightest reference to the baffles which Minerals Separation's expert witness, Dr. Liebmann, testified are absolutely essential to effect the turbulent agitation necessary for the alleged new process of the patent in suit. In criticising an operation performed according to the directions of the patent in suit by Dr. Byrnes, Respondent's expert witness, Dr. Liebmann, expert witness for Minerals Separation, made the following statement:

> "But the chief objection to this experiment is that Dr. Byrnes did not carry out the instructions of the patent to introduce air into the mixture of pulp and oil by agitation to form the froth. The cone mixer used was without baffles, that is, without the element necessary for the introduction of air into a liquid, and the necessity of the presence of baffles would be obvious to any metallurgist, whether he knew the apparatus or not." (Transcript, pages 316, 317, folios 643, 644.)

As a matter of fact, the patent in suit does not show or mention any "baffles," as fully set forth on page 56 of this brief, under the caption "No Operative Apparatus Described in Patent in Suit," and the record contains no proof that the Gabbet, or cone-mixer, was well known, or known at all, in the United States, but, even assuming that this apparatus had been well known, the fact still remains that the patent in suit contains no directions to use agitation more violent, or in any way different from the agitation recommended in the prior art patents, publications, and documents. On the contrary, Dr. Liebmann takes the position in the statement above quoted that means for securing the brisk agitation referred to in the patent in suit were well

known and obvious to any one. The inference is inevitable then, even upon Dr. Liebmann's theory, that the directions contained in the prior art patents and documents to agitate the pulp "thoroughly" and "violently" were sufficient to enable the operator to carry out the process at a date long prior to that of the alleged invention set forth in the patent in suit.

Patent in Suit Contains Only One Brief Reference to Air as Cause of Flotation, and No Reference to Any New Means of Introducing Air.

Upon the subject of air the patent in suit contains only a single statement, wherein it is asserted that the froth or scum derives "its power of flotation mainly from the inclusion of air bubbles introduced into the mass by the agitation. . . ." (Transcript, page 476, next to last paragraph.) Surely, no patentable discovery is involved in the observation of the obvious fact that a froth or foam floats by reason of the air in the bubbles of which it is formed, and, in any event, patentable novelty cannot be predicated upon a theory as to the cause of an old effect in the absence of some new means for producing that effect. As appears above, no new means for introducing air is disclosed in the patent in suit, because the means employed—agitation—is the same as that essential to and described as forming part of all of the old oil flotation processes.

The Claims of the Patent in Suit.

The claims which Petitioner charges are infringed are Nos. 1, 2, 3, 5, 6, 7, 9, 10, 11 and 12. (Transcript, page 61, Q. 16.)

The subject-matter of the claims was analyzed by Judge Gilbert, and we quote the following from the opinion of the Court of Appeals delivered by him:

> "There are thirteen claims in the patent. The first is 'the herein described process of concentrating ores, which consists in mixing the powdered ore with water, adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1 per cent. on the ore), agitating the mixture until the oil-coated mineral matter forms into a froth, and separating the froth from the remainder by flotation.' The next three claims specify the quantity of oil as amounting to 'a fraction of 1 per cent. on the ore.' The second claim adds to the first the use of slightly acidified water. The third adds to the second, 'warming the mixture.' The fourth adds to the third 'and removing the oily coating from the mineral.' The fifth specifies the oil as 'oleic acid of a quantity of from 0.02-0.5 per cent. on the ore.' The sixth adds to the fifth the use of water containing 1 per cent. of sulfuric acid. The seventh adds 'warming the mixture to 30°-40° Centigrade.' The eighth specifies the use of oleic-soap solution, to produce oleic acid, 'amounting to 0.02-0.5 per cent.' The ninth is 'the process of concentrating powdered ores which consists in separating the mineral from the gangue by coating the mineral with oil in water containing a small quantity of oil, agitating the mixture to form a froth, and separating the froth.' The tenth adds to the ninth 'warming the mixture,' and the eleventh adds the use of acid. The twelfth adds 'separating the froth from the remainder of the mixture,' and the thirteenth adds a current of water to carry off the coarser minerals, and 'filtering off the froth and re-

moving the oleic acid therefrom by treatment with an alkali'."

The claims set forth neither any new element nor any new combination of old elements. They are simply a list of old substances and old operations, all of which had been used previously in combination.

Brief Discussion of Prior Art with Regard to Amount of Oil, Degree of Agitation, and Result.

Before discussing the prior art in detail we will at this point refer briefly to several of the prior art processes in connection with the degree of agitation, amount of oil used and the results accomplished by those processes.

Haynes British Patent.

The Haynes British patent, No. 488 of 1860 (Transcript, page 523), recommends the use of one part of the oily mixture to from five to nine parts of ore (Transcript, page 525, just above middle of page), *i. e.*, from *11 to 20 per cent. of oil to ore by weight,* the mixture to be *agitated* with hot, warm or cold water, whereupon, as stated by the patentee, the *earthy matter sinks* and the metal is retained by the oil. (Transcript, page 526, top of page.) This clearly *indicates a flotation process* inasmuch as the earthy matter is described as "sinking," and the metal as being retained by the oil. Haynes states that he removes the earthy, or foreign, matter, replaces it with fresh ore and repeats this until the "agent" —*i. e.*, the oil—will take up no more metal. (Transcript, page 525, top of page.) The successive removal of earthy matter and the replacement thereof by fresh ore would, of course, *progressively decrease the proportion of oil*

to ore, and Haynes states that he continues such replacement of earthy matter or gangue with fresh ore until the oil will not take up any fresh metal. By this procedure, Haynes obviously reduced the proportion of oil to ore to an absolute minimum. Even the 11 per cent. of oil with which Haynes started absolutely excludes the possibility of his process belonging to the Elmore bulk oil type of flotation for which from 100 to 300 per cent. of oil is necessary.

Everson Process.

The Everson process is described in the Everson United States patent, No. 348,157, of 1886 (Transcript, page 579), and in two publications which are in evidence, namely, the Fryer Hill publication and the Criley and Everson publication. (Transcript, pages 414 and 415.)

Everson Patent.

The Everson patent contains directions for the use of *oil in quantities varying from 5 to 18 per cent.* (Dr. Liebmann, Transcript, page 330), and *also contains directions for "thorough agitation"* (Transcript, page 582, line 3), after which *the concentrate is to be floated off.* (Transcript, page 582, lines 5 and 6.)

Fryer Hill Publication.

The Fryer Hill publication (Transcript, page 414) is an article that appeared in the Daily Herald-Democrat of Leadville, Colorado, on October 30, 1889. The operation described in this article is an application of the Everson process as stated by Drs. Chandler and Liebmann. (Transcript, pages 366, 256 and 334.) The ar-

ticle contains a statement that the oil used was petroleum, but does not state the quantity of oil; that the ore was crushed sufficiently to pass through a 40-mesh screen, mixed with the oil, placed in a mixing apparatus, wherein after mixing the mineral-charged oil floats and the superfluous water is drained off.

Criley and Everson Publication.

In the Criley and Everson publication (Transcript, page 415) the operation described is termed the "Criley and Everson Oil Process," and is another application of the Everson process as stated by Drs. Chandler and Liebmann. (Transcript, pages 366, 256 and 334.) The Criley and Everson publication is an article that appeared in the Engineering and Mining Journal in the year 1890. It is stated in this article that the ore was crushed fine enough to pass through a 50-mesh sieve, mixed with black oil and acidulated water; that *after mixing "a thick scum of sulphurets rose to the surface and was skimmed off,* leaving the hitherto black ore as white as snow."

Summary of Everson Process.

The evidence shows conclusively that the Everson process was of precisely the same type and involved precisely the same principles as the process set forth in the patent in suit.

As above noted, the Everson patent refers to floating off the concentrates; the Criley and Everson publication refers to the floating material as "a thick scum of sulphurets" which was skimmed off; the Fryer Hill publication contains a description of a suitable mixing apparatus; and the Everson patent refers to the use of from

5 to 18 per cent. of oil. Assuming that the operator made no attempt at economy in the use of oil, but simply used 18 per cent., the operation could by no conceivable possibility be bulk oil flotation of the Elmore type, for which purpose from 100 to 300 per cent. of oil is necessary. The agitation and mixing referred to in the Everson patent and in the publications excludes the possibility of surface tension flotation, for which purpose it is necessary that the mineral particles be gently deposited upon the surface of the water. Furthermore, the Criley and Everson publication makes reference to the float as "a thick scum," which shows conclusively that the float was not of the surface tension or film flotation type, wherein the floating matter consists of a layer not exceeding one particle thick, as above stated with citations to the record. (*Supra*, pages 20, 21.) The Everson process could by no conceivable reasoning have produced any float other than that described in the Criley and Everson publication, namely, a thick scum, and this scum could not have floated other than by the inclusion of air bubbles introduced by the agitation and mixing referred to in the Everson patent and in the publications.

The Froment Process.

The Froment process is described in the Froment British patent No. 12,778 of 1902 (Transcript, page 706), and in the Froment Italian patent (Transcript, page 471), a translation of which appears at page 472 of the Transcript; also in the Froment description (Transcript, page 406) and the Froment plan (Transcript, following page 556) and Froment drawing "A" (Transcript, following page 556). A translation of the Froment description and of the descriptive matter on the plan and on the drawing "A" appears at page 409 of the Transcript.

Froment Patent.

In the Froment British patent (Transcript, page 706) Froment recommends, in an example of his process performed in a test tube, the use of a thin layer of oil, which thin layer would contain from .15 to .225 cc. in the case of turpentine, olive oil, wood tar oil, pine oil, and pinoline. (Dr. Liebmann, Transcript, page 354.) Dr. Chandler gave the specific gravity of these oils as ranging from .865 to .95. (Transcript, page 385.) Multiplying the volumes of oil given by Dr. Liebmann by the specific gravities given by Dr. Chandler, the weights of the amounts of different oils necessary to form a layer are found, and dividing the weights of the oil by 10 (the weight in grammes of ore used by Froment in the example of his process described in the patent), the percentage of oil to ore by weight is found to range from 1.3 to 2.27 per cent.

In the case of thick and viscous oils a thin layer would amount, according to the particular oil used, to from 5 per cent. (Ballantyne, Transcript, page 236, folio 478) up to as high as 12.5 per cent. (Dr. Liebmann, Transcript, page 287, top of page; page 295, line 10). Froment in his patent, Transcript, page 708, lines 14, 15) directs that the mixture of ore, oil, water, acid, and lime be agitated for a brief space, after which the whole of the chalcopyrite (the copper mineral) instantly rises to the top. In a preceding part of his specification, in the paragraph numbered 3, Froment states that the bubbles of gas become covered with an envelope of sulphides and rise readily to the surface, where they form a kind of metallic magma.

Froment's inventive idea, as appears from his patent, was the introduction of limestone and acid into the pulp being treated for the purpose of generating carbonic

acid gas to form bubbles. As will appear from the detailed discussion of the Froment process, appearing at a later point in this brief (pages 122 to 129 and 157, 158), carbonic acid gas formed from acid and limestone, or calcite, as limestone is sometimes termed, enters into the practice of the process of the patent in suit as carried out by Minerals Separation, Limited, and in view of the prior art the inference is inevitable that Froment sought merely to improve the operation of the process by adding the effect of chemically generated carbonic acid gas to the effect of mechanical agitation, the mechanical agitation having the effect in all the prior art processes of introducing air.

The amount of oil described by Froment, ranging from 1.3 per cent. to the maximum of 12.5 per cent. stated by Dr. Liebmann, is inadequate to produce even a suggestion of the Elmore bulk oil effect which requires from 100 to 300 per cent. of oil. The Froment process did not result in film flotation for the reason that the float was not a mere layer, one particle thick, but consisted of bubbles covered by an envelope of sulphides, as stated by Froment in his patent. Furthermore, Froment's manipulation including agitation could not produce film flotation, but necessarily did introduce air and form a froth.

The Froment Description.

A translation of the Froment description appears at page 409 of the Transcript, and in this description Froment recommends the use of oil ranging from 1 to 3½% by weight relative to the ore. The oil quantities are given by Froment near the bottom of page 411 and top of page 412 of the Transcript. As will appear in the detailed discussion of the Froment description appear-

ing at pp. 140-142 of this brief, Froment described an agitating apparatus of the precise type used in the practice of the Minerals Separation process, and directed a speed of agitation practically identical with the speed ordinarily used by Minerals Separation, Limited. If the Minerals Separation process involved the beating in of air to form a froth, Froment necessarily had the same idea, inasmuch as he used an apparatus of the same type operated in the same way. The Froment description was known to all three of the joint grantees of the patent in suit long before the date when they claim to have invented the process therein set forth, and the Froment process, which was patented only in England and Italy, was bought by Minerals Separation, Ltd., long before the alleged date of invention of the process of the patent in suit, all of which is set forth in detail in the subsequent more detailed discussion of the Froment process.

Froment's process, involving the use of quantities of oil ranging from 1 to 3%—according to the description—and upward to 12½%, according to Dr. Liebmann's testimony, could by no possibility have involved the Elmore bulk oil principle, which cannot be carried out with less than 100 to 300% of oil, and that the operation did not result in film flotation is obvious from the fact that Froment recommends agitation of precisely the same degree as that used by Minerals Separation, Limited, and from the further fact that in his British patent he describes the float as "bubbles covered by an envelope of sulphides."

The Kirby Process.

The Kirby process is described in United States patent No. 809,959 (Transcript, page 671) and apparatus for the practice of the Kirby process is described in United States patent No. 838,626 (Transcript, page 687). In his patent No. 809,959, Kirby directs that the mixture of ore, oil and water "be so thoroughly agitated together as to finely sub-divide said solution into small globules" (Transcript, page 672, middle of page), and in claims 1, 2 and 3 of his patent he defines his process as consisting "in violently agitating the mass so as to break up said immiscible substance into minute globules" (Transcript, page 678). Kirby in the same patent recommends the use of "a sufficient amount" of the oil mixture (Transcript, page 673, line 16), and adds that he has obtained excellent results by using from one-quarter to three-quarters as much oil by weight as ore. The apparatus described by Kirby is of the same general nature as that illustrated and described in the patent in suit, consisting of vessels with rotating mixers.

Obviously the Kirby process could not have been of the Elmore bulk oil type for the reasons:

First, that he recommends violent agitation to break the oil up into small globules, whereas the witnesses for Minerals Separation, Limited, as set forth on pages 12 to 20 of this brief, stated that violent agitation was fatal to the Elmore bulk oil process;

Second, for the reason that Kirby recommends the use of thin oils (Transcript, page 672, last paragraph), whereas the witnesses for Minerals Separation, Limited, say, as quoted on pages 12 to 20 of this brief, that thick and viscous oils are necessary for the Elmore bulk oil process; and

Third, the specific quantity of oil mentioned by Kirby, from one to three-fourths as much by weight as the ore, is too little to accomplish the Elmore bulk oil result, which requires from 100 to 300%, and the "sufficient amount" of oil mentioned by him is much less than the quantities specifically named.

Operations according to Kirby's directions demonstrate the correctness of these conclusions, namely, that in the Kirby process the inclusion of bubbles in the floating mass produced a froth of concentrates precisely as the process is carried out today.

Same Result Obtained by Use of Oil in Amounts Less and Greater Than One Per Cent.

After quoting from the patent in suit the statement (Transcript, page 475, last paragraph) that when the quantity of oil is reduced below the amount used by Cattermole, or as stated in the patent, below 1 per cent. of oil relative to the ore, the mineral is caused to "rise to the surface of the pulp in the form of a froth or scum," complainants' expert witness, Dr. Chandler, said:

> "This discovery is the foundation of the invention described and claimed in this patent." (Transcript, page 51, near top of page.)

Of course, Dr. Chandler could not have testified otherwise, inasmuch as the patentees explicitly state that their alleged invention resides in the discovery that a floating froth or scum is obtained when the quantity of oil is reduced to less than 1 per cent.

But the evidence shows conclusively and beyond the possibility of doubt that this floating froth or scum is produced by quantities of oil less than, the same as and greater than the quantities recommended by Cattermole. Therefore the patentees made no discovery, and the

froth produced by them did not result from so diminishing the amount of oil, but resulted from the fact that they agitated the oiled pulp as did the patentees of the prior art processes, and omitted the second stage of the Cattermole process—the slow, smooth rolling form of agitation by which Cattermole built up his sinking granules.

Flotation by agitation and the use of small quantities of oil was old in the art before the advent of Cattermole. Cattermole introduced his two-stage agitation for the purpose of building up the sinking granules. The patentees of the patent in suit then omitted Cattermole's slow rolling agitation, thus reverting to the procedure and obtaining the effect produced by the processes antecedent both to themselves and to Cattermole. In order, however, to make it appear that they had done something new and patentable the patentees of the patent in suit state that the floating froth produced by them is due to using less oil than used by Cattermole. That this statement is incorrect is shown by an abundance of evidence, including the testimony of one of complainants' engineers, Mr. Higgins, who testified on their behalf.

Brief Reference to Experiments With More Than and Less Than 1 Per Cent. of Oil.

At this point we present only the following brief reference to the evidence showing that the production of the floating froth or scum is not dependent upon the use of less oil than used by Cattermole, but results equally well from, and is the inevitable result of, the use of quantities of oil used in the prior art processes:

Defendant, James M. Hyde, testified regarding operations in which he produced a floating froth of concen-

trates by means of oil in amounts ranging from 0.05 per cent. to 3.6 per cent of the weight of the ore. (Transcript, pages 86-87.)

Dr. Eugene A. Byrnes, defendant's expert witness, testified regarding operations in which he produced a floating froth of concentrates by means of quantities of oil ranging from a fraction of 1 per cent. to 25 per cent. (Transcript, pages 105-108.)

A. Howard Higgins, metallurgical engineer for Minerals Separation, Limited, stated that he produced the characteristic floating froth of concentrates by means of oil in an amount equal to 3.6 per cent. by weight relative to the ore. (Transcript, page 387.)

Patent in Suit Deceptive as to Amount of Oil Necessary for Froth Production.

The patent in suit contains no suggestion that the process can be practiced with 3.6 per cent. or 25 per cent. of oil relative to the ore. The patentees knew that such a statement would prevent them from obtaining a patent; therefore, in order to make it appear that they had discovered something new, they made the statement quoted above and occurring in lines 16 to 35, page 1 of the patent in suit (Transcript, page 475, last paragraph) to the effect that the formation of a froth or scum grew out of and depended upon the use of a smaller amount of oil than used by Cattermole.

The patent in suit is so drawn as to imply that the Cattermole process constitutes the entire prior art, and no mention, direct or indirect, is made in the patent in suit to the many prior flotation processes. The Cattermole process, as a matter of fact, is a unique and somewhat fantastic operation, and is the only instance in either the earlier or later art in which oily substances are used for the purpose of causing metal-

liferous minerals to sink. In every other instance oily substances are used to cause metalliferous minerals to float. In order to give their process the appearance of novelty the grantees of the patent in suit contrasted it with Cattermole's exceptional and unique procedure, and made no mention of the many other prior oil processes in all of which oil was used to cause flotation.

Froth Produced Long Before Patent in Suit.

This froth or scum, as defined by complainants' witnesses, is precisely the same as that obtained by prior patentees, and in some instances the prior art patents and publications refer to the float by the very terms, "froth or scum," which appear in the patent in suit. For instance, the Engineering and Mining Journal of November 15, 1890 (Transcript, page 415) contains a description of a test working of the Everson process, in which it is stated that "a thick scum of sulphurets rose to the surface and was skimmed off, leaving the hitherto black ore as white as snow—in fact, pure silica." In the Froment British patent 12,778 of 1902 (Transcript, page 706), the float is described as bubbles covered by an elvelope of sulphides. The Glogner United States patent No. 736,381, of August 8, 1903, refers to the float as a froth. (Transcript, page 631.)

Furthermore, Minerals Separation, Limited, in British patent 23,870 of 1910, granted to that company as joint grantee with Edward H. Nutter, specifically recommends the process of British patent 12,778 of 1902, which is the Froment patent, and the processes of other patents as suitable methods for obtaining a froth or scum of concentrates by the use of oil and agitation. (Transcript, page 544, middle of page; *post,* pages 162 to 164.)

Minerals Separation, Limited, Abandons the Theory that a New Result is Produced by the Use of a Minute Amount of Oil, and Claims a Monopoly of All Operations that Result in the Production of a Froth or Scum.

Certain expert testimony was introduced by complainants to the effect that the process of the patent in suit includes the formation of a froth of concentrates by any means and by the use of any amount of oil or other equivalent reagent. This testimony has been introduced by complainants notwithstanding the testimony of their expert witness, Dr. Chandler (Transcript, page 51, top of page), that the use of less than 1 per cent. of oil is the foundation of the alleged invention; notwithstanding the statement in their British patent No. 23,870 of 1910 (referred to on pp. 48, 162-164 herein), in which they recommend the Froment and other processes as well-known means for producing a froth of concentrates, and notwithstanding that the testimony demonstrates that a froth could and would inevitably be produced by the prior art processes.

Following we refer to the testimony of complainants' witnesses indicating that they realize that no new result is obtained by using less than 1 per cent. of oil as directed in the patent in suit, and therefore lay claim to a monopoly of all processes in which a froth is produced regardless of the amount of oil used.

Dr. Liebmann Admits Production of Froth by Use of Large Amounts of Oil.

Dr. Liebmann (Transcript, page 299) stated that "it is impossible to produce the Froment result with the proportions between ore, oil and acid which Dr. Byrnes used . . ." The experiments performed by Dr. Byrnes to which Dr. Liebmann referred are described by Dr. Liebmann on page 297 to 299 of the Transcript, and Dr. Byrnes' description of these experiments begins at the bottom of page 107 of the Transcript. In the first experiment Dr. Byrnes used 492 grammes of ore and .3 cubic centimeters of cotton-seed oil, an amount less than 1% of the weight of the ore, and therefore within the limits described in the patent in suit. In the next three experiments the amount of cotton seed, olive, and red oil used was more than 3.6% of the weight of the ore and more than 12% of the weight of the zinc sulphide (*i. e.*, the metalliferous content) in the ore as stated by Dr. Byrnes (Transcript, page 108, about middle of page). In the fifth experiment, Dr. Byrnes used one-half as much red oil, which was about 1.8% of the weight of the ore and about 6% of the weight of the metalliferous content. Upon cross-examination (Transcript, p. 353), Dr. Liebmann admitted that he had not performed such an experiment as Dr. Byrnes', and was not speaking from personal experience, and added that if a froth was produced by Dr. Byrnes, it must lack some of the characteristics of the "agitation-froth" (meaning the froth produced by the alleged invention of the patent in suit). Dr. Liebmann continued his answer by making the following statement:

> "Dr. Byrnes says he has produced a froth with a large quantity of oil. If it is produced, it is not produced by the Froment process, but by the process

of the patent in suit. A froth such as can result from the quantities of oil used in four of the experiments would be valueless for the reason of its great expense." (Transcript, p. 353.)

The above-quoted statement made by Dr. Liebmann is in effect an admission that no new result is produced by the use of the small quantities of oil mentioned in the patent in suit. In stating that the froth produced by quantities of oil larger than the quantity mentioned in the patent in suit are produced according to the process of the patent in suit, Dr. Liebmann admits that the process of the patent in suit is old for the reason that the use of such larger quantites of oil is admittedly old. Dr. Liebmann says that an operation conducted with larger quantities of oil "would be valueless for the reason of its great expense." Even if this statement were true, it does not argue that there is anything of novelty in the operations described in the patent in suit, but on the contrary simply indicates that at most the grantees of the patent in suit in carrying out the old process merely exercised that economy incident to and necessary in all operations upon a large scale.

In commenting at another point in his testimony upon the same experiments of Dr. Byrnes, Dr. Liebmann made the following statement:

" . . . He then used the same process with very much larger quantities of oil and states again that he obtained a froth. There may be what is popularly called a froth, but this froth differs in characteristic qualities from the froth produced with the quantities of oil described by the patentees of the patent in suit as suitable and economical. It contains large quantities of oil which are quite visible and can even be detected by the touch. The appearance of the minerals is changed. They have a dull look and lack the metallic lustre of the minerals. The agitation froth produced with the quantities of oil which the patent in suit informs you

are suitable, does not disclose the presence of any oil. The faint traces of oil which must be there are absolutely invisible and only a careful chemical analysis can show their presence. To the touch the concentrates thus obtained are the same as the ordinary mineral which had never been treated with any oil. I cannot understand why Dr. Byrnes produced these experiments. *He only proves that he can produce, with much larger quantities of oil than are considered economical by the patent in suit, a froth, but at the same time he proves that the quantities recommended as economical in the patent in suit are economical.*" (Transcript, pages 305-306. (Italics ours.)

In the foregoing passage from his testimony, Dr. Liebmann admits that with large quantities of oil the result obtained by Dr. Byrnes may have been "what is popularly called a froth," but Dr. Liebmann says that the froth produced by Dr. Byrnes differs from the froth produced by the process of the patent in suit, in that the oil is visible and can be detected by the touch, and that the froth has a dull look and lacks the metallic lustre of the minerals, whereas, he says, a froth produced according to the process of the patent in suit does not disclose the presence of any oil. Inasmuch as Dr. Liebmann stated (Transcript, page 353, near top of page) that he had not himself made such an experiment as that made by Dr. Byrnes, it is not apparent how he was qualified to state that the froth produced by Dr. Byrnes with a large amount of oil looked dull and lacked metallic lustre, or that the oil was visible and could be detected by the touch.

Even granting, however, that Dr. Liebmann was by some means qualified to describe things he had never seen, the point is of no importance. It is quite evident that oil would be more apparent in a froth containing more oil than in a froth containing less

oil. As to the froth with a large amount of oil looking duller and lacking metallic lustre in appearance we are in considerable doubt as to the correctness of Dr. Liebmann's statement, but this again is an immaterial point. Respondent's contention is that froths are produced with the quantities of oil specified in the prior art, and are produced with quantities of oil many times greater than that directed in the patent in suit. Dr. Liebmann admits this in the quotations from his testimony appearing above.

That a froth with more oil in it may look more oily is a proposition that we do not deny. Our position simply is that the only difference between froths with smaller and larger amounts of oil is in the mere difference in quantity of oil; that the phenomena involved are the same; that in both cases the flotation is due to the inclusion of bubbles containing air, and in some instances containing bubbles of other gases chemically generated in the ore pulp; and that the use of the minimum amount of oily substance that will accomplish the result is simply a matter of the engineer's or the workman's skill in seeking the economy necessary in all large scale operations.

Dr. Liebmann, in the passage last above quoted from his testimony says, referring to Dr. Byrnes' experiments:

> "He only proves that he can produce, with much larger quantities of oil than are considered economical by the patent in suit, a froth, but at the same time he proves that the quantities recommended as economical in the patent in suit are economical." (Transcript, page 306, near top of page.)

What Dr. Liebmann admits to be proved is what we seek to prove, namely, that the amounts of oil used in the prior art produce a concentrate froth. We do not seek to prove that it is economical to use more oil than

necessary, but we do seek to prove, and Dr. Liebmann admits that we have proved, that the phenomenon is the same with large and small amounts of oil and the only difference is in the matter of that economy which the operator always introduces in practical work on a large scale.

Commercial Operations of Minerals Separation, Limited.

Minerals Separation, Limited, have introduced evidence whereby they seek to show that the alleged invention of the patent in suit has gone unto extensive use, from which evidence they seek to create the inference that the subject-matter of the patent in suit is a patentable invention.

The use of the alleged invention of the patent in suit, according to complainants' evidence, has been substantially confined to a certain part of Australia. Several instances are referred to by the witnesses in which their alleged process has been introduced in other localities, but the evidence does not show the extent of success which has attended the efforts of Minerals Separation, Limited, in the few localities mentioned outside of Australia.

Other Flotation Processes.

Furthermore, many flotation processes other than that exploited by Minerals Separation, Limited, have been and are used in practical operations, and complainants' process is by no means responsible for the introduction of flotation methods of concentration. George A. Chapman, one of the complainants' metallurgists who testified on their behalf, stated (Transcript, p. 185) that he left England for Australia about April, 1904, for the

purpose of installing the Cattermole process, and (Transcript, p. 186) that the Cattermole plant was completed and adjustment runs made in or about April, 1905. He also testified (Transcript, p. 201) that the Potter process was in operation during his visit to Australia, also the DeBavay process, and that the Delprat plant on the Proprietary mine was operating about the time that the flotation process exploited by Minerals Separation was gotten into operation.

Mr. Chapman also testified (Transcript, p. 201) that the Elmore vacuum plant at South Broken Hill commenced operations some months after Minerals Separation process was abandoned by the Zinc Corporation. It appears from the testimony of H. C. Hoover that the Zinc Corporation abandoned the Minerals Separation process after a few months' trial in 1907. (Transcript, page 171.) The Elmore vacuum process referred to is a gas-oil process (Nutter's testimony, Transcript, page 46, middle of page), and is totally different from the Elmore bulk-oil process hereinbefore referred to.

Mr. H. C. Hoover, one of defendant's witnesses, testified (Transcript, page 171) that when he first went to Broken Hill in 1905 he found in operation three flotation methods, namely, the Cattermole process of Minerals Separation, Limited; the Potter process, which was being operated by the Block 14 Company, and the Delprat method, which was being operated by the Broken Hill Proprietary. He added further on that the DeBavay method was also in use at that time on the Broken Hill north mine.

Minerals Separation, Limited, Does Not Use Process and Apparatus Described in Patent in Suit.

Furthermore, it appears from the evidence introduced by Minerals Separation, Limited, and discussed below, that the methods applied by them in the commercial application of the flotation process are not the methods set forth in the patent in suit. We think it unnecessary to dwell at length upon this subject, for the reason that extensive or successful use, even if proved, does not establish novelty or invention in the face of the fact clearly established by this record that the complainants were not the originators of the process in question.

No Operative Apparatus Described in Patent in Suit.

The apparatus used in practice by Minerals Separation, Limited, is not the apparatus illustrated and described in the patent in suit, and that apparatus has never been used in practice. No result of commercial utility can be obtained by the use of the apparatus described in the patent in suit, as shown by the testimony of respondent's expert witness, Dr. Byrnes, whose testimony (Transcript, pages 108-109) shows that he had an apparatus such as described in the patent in suit made and attempted to operate the same. While he obtained some froth, the amount of concentrate separated from the ore was so small that "the tailings showed hardly any perceptible change in color from the original ore, as was to be expected from the comparatively small amount of mineral removed by flotation." (Transcript, page 109, near middle of page.) Dr. Liebmann, expert witness for Minerals Separation, Limited, per-

formed a test with the same apparatus, which test he describes in the part of his testimony appearing on pages 314 and 315 of the Transcript. As stated by Dr. Liebmann (Transcript, page 314, lines 6 and 7 from bottom of page), he recovered only 57.6 per cent. of the mineral in the ore. Following this statement Dr. Liebmann says the reason he did not recover more was that he could not get all of the material out of the apparatus, and he proceeds to show that he could have gotten a higher recovery if he had been able to get the material out of the apparatus. It is to be observed that Dr. Liebmann's excuse for not getting a better result is based upon a defect in the apparatus, and it is furthermore to be observed that before performing his experiment with the apparatus constructed according to the directions of the patent in suit, he added thereto what he terms "the necessary baffles" (Transcript, page 314, lines 10 and 11). It appears, therefore, that the best showing Dr. Liebmann was able to make for the apparatus described in the patent in suit was the recovery of only a little more than half of the metalliferous mineral, and that he recovered this amount only after adding to the apparatus the baffles, which are neither illustrated nor described in the patent in suit.

Minerals Separation, Limited, attempted to excuse the inadequacy of the patent by producing witnesses, residents of England, who stated that apparatus of the kind shown in the patent in suit and called a Gabbet, was manufactured in London, and that the use of baffles in such apparatus was well known. The fact that something might have been well known to some residents of England regarding an apparatus manufactured in London in no way supplies the failure of a United States patent to describe something unknown in the United States that is essential to the working of the

patent. Defendant's expert witness, Dr. Byrnes, knew nothing of this apparatus, or of any custom of using baffles in it, as is shown by the apparatus with which he experimented and which is in evidence as Defendant's Exhibit Apparatus of Patent in Suit.

In criticizing the experiment performed by Dr. Byrnes with the apparatus of the patent in suit, Dr. Liebmann commented upon the fact that this apparatus as used by Dr. Byrnes contained no baffles and remarked that he (Dr. Byrnes) "apparently does not know a cone-mixer" (Transcript, page 313, line 17). It is quite true that Dr. Byrnes did not "know a cone-mixer," and this record does not show that any one in the United States knew what a cone-mixer or Gabbet was, or that baffles formed part of such an apparatus. Dr. Byrnes had the apparatus of the patent in suit constructed from the directions of the patent in suit. He utilized all of the information conveyed by the patent in suit, and the apparatus failed to produce any useful result.

The defense in this suit took no testimony to show that this apparatus and the baffles therein were unknown in the United States, for the reason that Minerals Separation introduced no testimony on this point prior to their rebuttal testimony, and then they failed to sustain the burden that rested upon them by reason of the fact that they failed to show that anyone in the United States had ever heard of this so-called "Gabbet," which is shown in the patent in suit without baffles, or that anyone in the United States had ever heard of such an apparatus or the use of baffles therein.

The omission from a United States patent of an essential feature surely cannot be remedied by showing what someone in a foreign country knew.

Minerals Separation, Limited, have introduced an old United States patent, No. 444,345 (Transcript, page

481), granted to one E. R. Gabbet in 1891, which shows an agitating apparatus provided with baffles, and have introduced three advertisements (Transcript, three pages preceding page 557) of a similar apparatus.

Mr. Young, a witness for Minerals Separation, Limited, testified (Transcript, pages 244, 245) that H. Young & Company of London, England, issued the first of these advertisements (Complainants' Exhibit Young First Circular) in 1890, but finding "that they were giving away too much information" they "changed the illustration by leaving out the baffles from the illustration." In the second and and third advertisements (Complainants' Exhibits Young Advertisements A and B), no baffles are shown. Young Advertisement A appeared in the Journal of the Society of Chemical Industry. Dr. Chandler says that this journal has an international circulation and that the advertisement therein was undoubtedly seen by him (Transcript, page 360), but as the advertisement shows no baffles the significance of this testimony is not apparent. Furthermore, the patent in suit contains no reference to either the Gabbet United States patent or to any of the advertisements.

Even if the Gabbet United States patent and the advertisements in the Journal of the Society of Chemical Industry could by complainants' theories of law be read into the patent in suit, the disclosure would still be incomplete, for the reason that no one would be taught that baffles were essential by reference to another patent showing baffles and to advertisements showing a similar apparatus with and without baffles.

Dr. Liebmann's testimony that baffles are essential (Transcript, pages 314-316) and the testimony of complainants' witness Chapman, that in practice complainants used the Gabbets or cone-mixers that were used

in the first treatment of the Cattermole process, *i. e.*, with baffles (Transcript, pages 183-184), and that afterward they used square agitating vessels (Transcript, page 187, near bottom), which are equivalent to circular vessels with baffles (Ballantyne's testimony, Transcript, page 232, near middle of page), plainly shows that no commercial use has been made, or could be made, of the patented process as exemplified in the patent in suit, in which is shown a round vessel without baffles.

Patent in Suit Contributed Nothing to the Art of Flotation.

The fact, as shown by this record, that the process exploited by Minerals Separation, Limited, has found only limited successful application, that no one attempted to use the process in the United States until Mr. Hyde made an effort in that direction in August, 1911 (Transcript, page 82, about middle of page), about five years after the grant of the patent in suit, the fact that Minerals Separation, Limited, does not now carry out its process as directed in the patent in suit, and the fact that in the year 1912, when this suit was tried, after six years of exploitation, the process was only used in Australia and a few other widely separated localities, is conclusive evidence that the patent in suit did not take the art of flotation out of the realm of experiment, but left the art where it had been for many years and where, in fact, it still is today—an interesting phenomenon that can be made practical use of for the concentration of some ores only, and for the concentration of those ores only after extended research and experiment.

As shown by this record, there really is no such thing as a flotation process. Flotation is a phenomenon that has

been observed to take place under certain conditions. If, from the observed phenomenon, some set of conditions could be devised that could be applied to all or a considerable number of ores with the result of effecting useful concentration, such set of conditions might properly be held to constitute a process. Such, however, is not the case. Neither in the patent in suit nor in any of the patents, documents, or literature prior or subsequent to the patent in suit does there appear any description of operations that can be applied to all or any considerable number of ores with the result of effecting concentration by flotation.

To apply flotation to the concentration of any ore it is necessary for the engineer to devise a process applicable to that ore. No two ores can be treated alike. In devising a method of treating an ore by flotation the engineer will utilize all available knowledge, and in most cases will be obliged to introduce original ideas before he can attain success. Such was the case in the application of flotation to the ore of the Butte & Superior Copper Company, this being the operation upon which the charge of infringement herein is based.

The idea of using in flotation concentration an amount of oil less than one per cent. of the ore by weight is no solution of flotation concentration. In the case of those ores to which flotation can be applied at all, flotation can be effected with quantities of oil vastly in excess of one per cent. of the ore by weight. In those cases where flotation concentration is in use success has been due to the proper adjustment and co-ordination of a large number of conditions, such as the thickness of the pulp, that is, the proportion of water to ore in the pulp; the temperature at which the pulp is treated; the use of some particular kind of oil or oily substances; the degree of

violence with which the pulp is agitated; the use or non-use of acid in the pulp; the amount of acid, if any, that is used; the time and place at which the acid is added; the length of time that the acid is permitted to act before the pulp is subjected to the flotation operation; the rate of flow of pulp through the flotation apparatus, such rate of flow determining the length of time to which the pulp is subjected to agitation; the character and mode of operation of the mechanical apparatus used for effecting the agitation of the ore pulp; and a multiplicity of other conditions. In the case of many ores no set of conditions can be found that will produce flotation concentration, and to such ores flotation cannot be applied. Even in the case of those ores to which flotation has been applied, disturbance of any of the conditions mentioned above, or of any of the other conditions found necessary, causes the process to fail. Each condition, and the proper co-ordination of that condition to the other conditions, is necessary, and no one condition can be said to be more important than any other where the precise regulation of all is necessary to success. There is nothing in this record to show, and it is not a fact, that precise adjustment of the amount of oil is any more necessary than the precise adjustment of any of the other mentioned conditions. On the contrary, this record indicates that there is much more latitude in the amount of oil that can be used without causing the process to fail than there is in the adjustment of the other necessary conditions.

Petitioners, Through Their Chief Engineer, Admit That Flotation Is Still an Experimental Art and That Each Ore Presents a Separate Problem.

Minerals Separation admits that there is no such thing as *a* flotation process; that widely differing kinds of treatment are necessary; that each ore presents a separate problem, and that flotation is an experimental art.

All of the foregoing is admitted by Minerals Separation, Limited, who produced as a witness their chief engineer, Edward H. Nutter. In the opening sentence of his testimony (Transcript, pages 39 and 40) Mr. Nutter states his official position as chief engineer of respondent, and states his qualifications as a metallurgical engineer.

In describing the application of the process alleged to be covered by the patent in suit, Mr. Nutter made the following statement:

> "*The steps of complainants' flotation process, which is the Agitation Froth process, are not always the same nor always taken in the same order on all ores,* but in the application of that process to the Butte & Superior ore the steps would consist of agitating an ore pulp, which had been acidulated with sulphuric acid and to which had been added less than one per cent. of an oily reagent; the agitation would take place with considerable vigor, after which the pulp would be conducted into a separating chamber, where the sulphide mineral would rise as a froth, which could be flowed off and collected and which would form the valuable concentrate. These steps would be repeated until the required extraction of the valuable constituents from the ore pulp had been obtained.
>
> "If it were necessary for me to test an ore, for the purpose of determining whether complainants' process was applicable to it, and I found it necessary

to make this test without apparatus, I would take the finely ground ore, mix it with water and reagents in a bottle, and shake the bottle vigorously. If the ore was amenable to flotation concentration, some indications of the formation of a froth would be made. *If I had a testing machine, of which there are more than one type, I would perform the operation in the machine and would vary the conditions in different tests on an ore to see which set of conditions gave the best results. The variations I would try would consist of agitation with or without sulphuric acid, with different oily reagents, with agitating the pulp before acid should be added, with agitating the water, sulphuric acid and oily reagent before adding the ore, with agitating the pulp to some extent with the acidified water before adding the oil, with using water of different temperatures, and, in fact, almost any combination or variation of these conditions that the indications given as I went along seemed to warrant.*" (Transcript, page 43.) (Italics ours.)

Later Mr. Nutter testified as follows regarding the application of the Minerals Separation process:

"If in attempting to carry out Minerals Separation's flotation process I found that some of the metalliferous mineral agglomerated and sank to the bottom, *I would alter the adjustment of operations step by step until I found a condition wherein sunken granules were not discharged with the tailings.* I would try the following adjustments in my attempt to find proper conditions to produce flotation; (1) I would alter the rate of flow of pulp through the plant; (2) I would alter the speed of agitation; (3) I would alter the quantity, or (4) the kind of oil used on the particular ore being treated; (5) I would alter the dilution of the solution circuit with reference to salts dissolved therein; (6) I would alter the temperature of the solution circuit; and (7) I would vary the internal arrangement of the baffles or other diverging devices so as to affect the direction of flow of the ore plup. All of these adjustments might have some effect or any of them might have an effect upon the for-

mation of the agglomerations that I have described. It is likely that an inspection of a plant by one skilled, like myself, in the art would indicate to me the probable adjustment called for. I cannot say whether, if the oil supply needed readjustment, I would increase or diminish the supply when the process was operating imperfectly. *The effects are so various with different* (83-10) *oils under different conditions that it is hard to say in advance what I would do without studying a particular case of ore treatment where sinking agglomerations were being formed.*

"I could in particular cases lay down a definite rule as to the course to be pursued to produce the flotation effect without that effect being accompanied by the setting of agglomerated masses of sulphide. If an ore were being treated and it was found that the readjustments previously mentioned by me did not diminish the agglomerating and sinking effect, and if the quantity of oleic acid used was in excess of the usual amount found necessary, I would lay down a rule that the quantity of oleic acid should be diminished. When oleic acid is used, better results are obtained in a heated circuit than in a cold circuit." (Transcript, pages 44-45.) (Italics ours.)

Minerals Separation, Limited, offered in evidence a report made by Mr. Nutter on December 3, 1910. This report appears at page 461 of the Transcript, as follows:

"It will hardly be accurate to refer to this paper as a report as it is almost necessarily an argumentative discussion embodying my personal views concerning the relative importance of the various unsolved problems, and the most promising lines of investigation leading to their solution.

"One of the most important group of problems is that concerned with the development of the best design of plant for carrying on the essential operations which go to make up the Minerals Separation flotation process. *It is to be understood of course, that no design can be completely worked out in advance that will be suitable for all ores, or for any*

ore. The different parts of the general problem will have different weights in the different cases, and the relative importance of the different operations will hardly be the same at any two mines. *In other words each ore presents a separate problem to us as well as others.*" (Transcript, page 461.) (Italics ours.)

Upon cross-examination Mr. Nutter was asked a question concerning the effect of different kinds of gas in flotation. Following is his reply:

> "*As flotation concentration is an experimental art,* I am unable to give an intelligent judgment on this point . . ." (Transcript, page 46; X-Q. 168.) (Italics ours.)

Mr. Nutter's testimony above quoted, and the fact that at the time of the trial of this case—some six years after the grant of the patent in suit—the so-called Minerals Separation process has been used only in Australia, and two or three other widely separated localities, conclusively shows that the patent in suit does not solve the question of flotation concentration, but leaves flotation just where it was before, namely, to use Mr. Nutter's words, "an experimental art." In fact, the patent in suit contains nothing not found in the prior art that tends in the slightest degree to assist the engineer engaged in the attempt to apply flotation to some particular ore. The one thing that every engineer has in mind in applying any process is economy, and any engineer who finds an ore amenable to flotation concentration would inevitably proceed to make the operation as economical as possible. The use of the smallest possible amount of oil is incidental to the application of flotation to those ores to which it is applicable, and is in no sense the effective cause. Ores that can be floated with less than 1 per cent. of oil can be floated with

more than 1 per cent. of oil, and as soon as the engineer finds that an ore can be floated at all, economy of reagents is the inevitable next step.

Law on Use of a Patented Article or Process.

The elements of the flotation process, as defined in the patent in suit, are individually and collectively old, and such use as has been made of flotation cannot be attributed to the patent in suit any more than to the prior patents and publications. Under such conditions the extent of use of the flotation process has no bearing upon the issue, and, as shown by the cases from which we quote below, the utmost caution has always been exercised in attaching any weight to the use of a patented process or machine even in those instances where some degree of novelty was found to exist.

In the case of *McClain* v. *Ortmayer,* Mr. Justice Brown, delivering the opinion of this Court, made the following statement:

> "That the extent to which a patented device has gone into use is an unsafe criterion even of its actual utility, is evident from the fact that the general introduction of manufactured articles is as often effected by extensive and judicious advertising, activity in putting the goods upon the market, and large commissions to dealers, as by the intrinsic merit of the articles themselves. The popularity of a proprietary medicine, for instance, would be an unsafe criterion of its real value, since it is a notorious fact that the extent to which such preparations are sold is very largely dependent upon the liberality with which they are advertised, and the attractive manner in which they are put up and exposed to the eye of the purchaser. If the generality of sales were made the test of patentability, it would result that a person by securing a patent upon some trifling variation from previously known methods might, by energy in push-

ing sales or by superiority in finishing or decorating his goods, drive competitors out of the market and secure a practical monopoly, without in fact having made the slightest contribution of value to the useful arts. The very case under consideration is not barren of testimony that the great success of the McClain pads and clasping hooks, a large demand for which seems to have arisen and increased year by year, is due, partly at least, to the fact that he was the only one who made the manufacture of sweat pads a specialty, that he made them of a superior quality, advertised them in the most extensive and attractive manner, and adopted means of pushing them upon the market, and thereby largely increased the extent of their sales. Indeed it is impossible from this testimony to say how far the large sales of these pads is due to their superiority to others, or to the energy with which they were forced upon the market.

"While this court has held in a number of cases, even so late as *Magowan* v. *New York Belt. & Pack. Co.* (*ante,* 981), decided at the present term, that in a doubtful case the fact that a patented article had gone into general use is evidence of its utility, it is not conclusive even of that—much less of its patentable novelty."

McClain v. *Ortmayer,* 141 U. S., 419, 12 Sup. Ct. Rep., 76; 35 L. Ed., 800.

On the subject of use of an alleged invention, Mr. Justice Brown, delivering the opinion of this court, commented as follows in *Duer* v. *Corbin:*

"It is true the Orum lock seems to have gained an immediate popularity, to have met with large and increasing sales, and to have had the usual effect of successful patents in stimulating the activity of business competitors to produce an equally useful and popular device. Were the question of patentability one of doubt this might suffice to turn the scale in favor of the patentee. But there are so many other considerations than that of novelty entering into a question of this kind that the popularity of the article becomes an unsafe criterion.

For instance, a man may, by the aid of an alluring trade-mark, succeed in catching the eye of the people, and palming off upon them wares of no greater intrinsic value than those of his rivals; but such trade-mark may be, and usually is, wholly destitute of originality, often taken from some prior publication, and appropriated to the specific purpose of the owner. The same result may follow from the more attractive appearance or the more perfect finish of the article, from more extensive advertising, larger discounts in price, or greater energy in pushing sales. While the popularity of the Orum lock may be due to its greater usefulness, or to the fact that it was put upon the market just at the time when the cabinet makers were looking for a lock of this description, it is certainly not due to any patentable feature in its construction."

Duer v. *Corbin*, 149 U. S., 216; 13 Sup. Ct. Rep., 850; 37 L. Ed., 707.

To the same effect was the ruling of this court in *Olin* v. *Timken*, as appears from the following quotation from the Court's opinion, delivered by Mr. Justice Miller:

". . . And while the patented article may have been popular and met with large sales, that fact is not important when the alleged invention is without patentable novelty. *Duer* v. *Corbin Cabinet Lock Co.*, 149 U. S., 216 (37:707)."

Olin v. *Timken*, 155 U. S., 141; 15 Sup. Ct. Rep., 49; 39 L. Ed., 100.

The law as defined in the cases from which the foregoing quotations were taken has been uniformly followed by the lower courts, the following being a few of the cases in which the point has arisen:

Falk Mfg. Co. v. *Missouri R. R. Co.*, 103 F. R., 295, decided by the Circuit Court of Appeals for the Eighth Circuit;

Standard Caster & Wheel Co. v. *Caster Socket Co.*,

113 F. R., 162, decided by the Court of Appeals for the Sixth Circuit;

Goodyear Tire & Rubber Co. v. *Rubber Tire Wheel Co.*, 116 F. R., 363, decided by the Court of Appeals for the Sixth Circuit; and

American Sales Book Co. v. *Bullivant*, 117 F. R., 255, decided by the Circuit Court of Appeals for the Ninth Circuit.

Upon the subject of the extent of use of the invention as a factor in the consideration of the question of validity of the patent, Judge Gilbert, in the opinion of the Circuit Court of Appeals for the Ninth Circuit in the case at bar, commented as follows:

> "The decision of the court below appears to have been largely influenced by the consideration that the appellees' patent had gone into extensive and successful use. The fact that a patented device or process has gone into extensive and successful use is often of value in determining the question of invention and patentability. It is referred to for the purpose of turning the scales in cases of grave doubt. It is of no value whatever where the question of invention or patentability is free from doubt, and in any case its value depends largely upon the causes which produced it. It is often due to business ability in manufacturing, exploiting and advertising, and to the fact that prior conditions have not stimulated development. The appellees' process, originally patented in Great Britain, has been installed in Australia, Sweden, Finland, Chile and Wales, and it is in the process of installation in Cuba. It is not improbable that in those countries the prior art may have been substantially unknown, and it is possible that the appellee's success there is referable to the fact alleged in the bill, 'that the complainants have been to great trouble and expense in the introduction into use of the process, and have invested large sums of money in its introduction into commercial use in different parts of the world, and in the effort to introduce it into commercial use in the United States.' It is

in evidence that in making the process known to the public in the United States, the appellees have expended $60,187. Notwithstanding these efforts and expenditures, their process has not yet been installed in the United States. In *Olin* v. *Timken*, 155 U. S. 141, 155, it was said: 'While the patented article may have been popular and met with large sales, that fact is not important when the invention is without patentable novelty.' In *McClain* v. *Ortmayer*, 141 U. S. 419-428, the court said that 'the extent to which a patented device has gone into use is an unsafe criterion even of its actual utility, is evident from the fact that the general introduction of manufactured articles is as often effected by extensive and advantageous advertising, activity in putting the goods upon the market, and large commissions to dealers, as by the intrinsic merit of the articles themselves.' "

Transcript, pages 721 and 722.

The British Litigation.

Petitioners in their petition for the writ of certiorari which has brought this case before this Court, represented that the decision of the Court of Appeals for the Ninth Circuit was at variance with the decisions of the House of Lords of Great Britain and the Privy Council of the British Empire in suits originating respectively in England and Australia.

We discuss this subject at some length for the reason that Petitioners made this representation for the avowed purpose of inducing this Court to issue the writ of certiorari and for the purpose of influencing the decision of this Court. The allegation that there is a variance between the decision of the Court of Appeals for the Ninth Circuit and the judgments rendered by the British Courts is without any vestige or suggestion of foundation. The issue in the British litigation was not the same as or even similar to the issue of the case at

bar, and there was therefore not even the possibility of any disagreement.

In the British litigation the owners of patents upon a detail of the Elmore bulk oil process, namely, the use of acid in that process, brought suit against Minerals Separation, Limited, and one of its licensees, charging that the pactice of the process used by Minerals Separation, Limited, and its licensee was an infringement of the Elmore patent referred to. The alleged infringing process was the so-called "agitation froth process" set forth in United States patent No. 835,120, this being the patent here in suit, which Mr. Hyde is charged with infringing. (Petition for writ of certiorari, page 5.) The British courts decided that the "agitation froth process" was not an infringement of the British patent upon the use of acid in the Elmore bulk oil process. The Circuit Court of Appeals for the Ninth Circuit decided that the United States patent upon the "agitation froth process" was anticipated and is invalid. The decisions of the British and United States courts are not only not in conflict, but they do not even touch upon the same ground or bear upon the same issue. Furthermore, it so happened that the Court of Appeals emphasized the perfect harmony that exists between its decision and those of the British courts. The British courts held in effect that the "agitation froth process" is different from the Elmore bulk oil process. In the Court of Appeals, Minerals Separation, Limited, contended that the anticipatory processes relied upon by defendant-appellant were of the same type as the Elmore bulk oil process and that they therefore were not anticipations. But the Court of Appeals found that the anticipatory processes relied upon by defendant-appellant were not of the Elmore bulk oil type, but were identical with the so-called "agitation froth process" of

United States patent No. 835,120 in suit. (Transcript, page 720.)

There was, therefore, no conflict between the decree of the Court of Appeals and the British judgments for the simple reason that the issues were not the same or even similar. The reasoning by which the Court of Appeals and the British courts arrived at their conclusions was in strict harmony, it being found by the tribunals of both countries that the "agitation froth process" is a different thing from the Elmore bulk oil process.

In the foregoing paragraphs we have briefly stated the relation between the decisions of the Court of Appeals and the British courts. Below we discuss the subject more in detail.

History of the British Litigation.

All questions relating to the British litigation were fully presented by Minerals Separation, Limited, to the Court of Appeals, and the decision of the Court of Appeals was arrived at with full knowledge of the facts, and, as we will show below, necessarily with full knowledge that there was no conflict between their findings and those of the British courts. In their petition for rehearing, filed in the Court of Appeals, Minerals Separation, Limited, made reference to the fact that, in their brief on the hearing of the appeal, they had discussed the decision of the House of Lords in *British Ore Concentration Syndicate, Limited,* v. *Minerals Separation, Limited,* and stated that since the argument in the Court of Appeals another decision had been rendered by the Privy Council (Transcript, pages 744-745), both decisions being in suits brought by the owners of the Elmore bulk oil flotation patents.

Minerals Separation, Limited, has incorporated in its petition for writ of certiorari the judgment of the House of Lords (petition for writ of certiorari, page 41), and has incorporated the judgment of the Privy Council in its petition for rehearing in the Court of Appeals (Transcript, page 747).

The Judgment of the House of Lords.

This suit was brought in England by the British Ore Concentration Syndicate, Limited, against Minerals Separation, Limited, petitioner herein.

The patents upon which the charge of infringement was based in the case that went to the House of Lords were British patent No. 21,948 of 1898, granted to Francis Edward Elmore, and No. 6519 of 1901, granted to Alexander Stanley Elmore. (Petition for writ of certiorari, pages 41, 42 and 48.)

The Elmore British patents referred to are not in evidence, but as stated by Mr. W. H. Ballantyne, an expert witness for Minerals Separation, Limited, the Elmore process is described in United States patents No. 676,679, granted to Francis Edward Elmore, and No. 689,070, granted to Alexander Stanley Elmore, the process described in the later patent differing from that described in the earlier one only in the use of acid (Transcript, page 213). The two United States Elmore patents appear at pages 608 and 612 of the Transcript.

The alleged infringing act was the practice by Minerals Separation, Limited, of the process set forth and claimed in U. S. patent 835,120, this being the patent here in suit which Petitioners charge has been infringed by the Respondent. (Petition for writ of certiorari, page 5.)

The charge of infringement of the 1898 patent was withdrawn, this patent being for the idea of mixing the pulverized ore with water and then adding thick oil with the result that the oil entrapped the metallic particles and floated them while the rocky substance or gangue remained at the bottom of the vessel (judgment of the House of Lords, page 42 of petition for writ of certiorari). The 1901 Elmore patent was for the idea of using acid in connection with the process of the 1898 patent. Following is the claim of the 1901 patent as quoted in the opinion of the House of Lords:

> " 'The method herein described of promoting the separation of mineral substances by the selective action of oil, by adding to the mixture of ore, water and oil, a proportion of acid.' " (Petition for writ of certiorari, page 44.)

The House of Lords in the part of the judgment delivered by the Lord Chancellor held that the Everson United States patent disclosed the use of acid for the purpose claimed and that the claim of the Elmore 1901 patent was so wide as to include the use of acid in any mixture of ore, oil and water, and was therefore anticipated and invalid, and that anticipation was not defeated by the fact that Everson described the admixture of the oil and acid with the dry ore to form a paste before the addition of water (judgment of House of Lords, page 45 of petition for writ of certiorari).

That the process disclosed in the Elmore 1901 patent is the Elmore bulk oil process, referred to elsewhere in this brief (pages 8 to 20), is shown by the reference made by Lord Shaw in the judgment of the House of Lords to Mr. Swinburne's testimony that the quantity of oil required for the process of the patent is from one to two-and-a-half tons per ton of ore to be treated (petition for writ of certiorari, page 56).

The Earl of Halsbury held that the Minerals Separation process was essentially different from the Elmore process in that the Elmore process depends upon the selective action of oil and the Minerals Separation process upon surface tension, but he expressed his full agreement with the Lord Chancellor (petition for certiorari, page 46).

Lord Atkinson found that the Elmore patent was susceptible of three possible constructions which he enumerates (petition for writ of certiorari, page 50), and he found that the invention, if any there were, to reside in the third construction (petition for writ of certiorari, page 53), namely, that Elmore's invention consisted in the addition of acid to a mixture of powdered ore, oil and water, the quantity of oil being so large as to float the metallic particles by its buoyancy. Upon this ground Lord Atkinson found that their was no infringement.

Lord Shaw found that the Elmore patent covered a bulk oil process depending upon the lesser specific gravity of the oil, and requiring "from one to two-and-a-half tons per ton of ore to be treated" (petition for writ of certiorari, pages 55 and 56). He found that in the case of the Minerals Separation process "instead of relying upon the lesser specific gravity of oil in bulk they rely upon the production of a froth" (petition for writ of certiorari, page 59). Just preceding the passage quoted, Lord Shaw says that Minerals Separation "are engaged upon a new method of separation", but obviously Lord Shaw simply meant that the Minerals Separation process was new in the sense of being different from the Elmore process. Neither the novelty of the Minerals Separation operations nor the validity of any patent upon these operations was in issue or in any possible way involved in the British litigation.

The Judgment of the Privy Council.

The suit decided eventually by the Privy Council originated in New South Wales, Australia, where the Ore Concentration Company, Limited, brought suit against The Sulphide Corporation, Limited, charging infringement of New South Wales patents No. 10,001 of 1900, granted to F. E. Elmore, and No. 11,307 of 1901, granted to A. S. Elmore. As to the 1900 patent the action was abandoned at the trial, and the action was limited to claim 1 of the 1901 patent (Judgment of Privy Council Transcript, page 747). Following is claim 1 of the patent:

> "In processes for separating minerals by the selective action of oil, the addition of a small quantity of acid to the oil or water employed in the process, or to both, substantially as and for the purpose set forth." (Transcript, bottom of page 752 and top of page 753.)

The act complained of as an infringement was the practice of the process described in United States patent 835,120 here in suit. (Petition for writ of certiorari, page 5.)

The Privy Council referred to the case previously decided by the House of Lords and noted the fact that the specification of the Everson United States patent was before the House of Lords, while only the claims of the Everson patent were before the Privy Council, and also referred to the fact that the Criley and Everson publication was not pleaded in the case decided by the House of Lords. (Transcript, page 748.)

The Privy Council first commented on the judgment of the House of Lords in the earlier case and then proceeded to discuss the art prior to the Elmore patent. (Transcript, page 748.)

The first prior art patent taken up by the Privy Council is the Haynes British patent of 1860. Lord Parmoor, who handed down the decision of the Privy Council, said that Haynes' patent "describes a method of separation of metal from gangue by the use of an agent containing fatty or oleaginous matter," and added the statement that "This document is, however, not more than an indication of the date at which attention was first directed to the affinity of oil for metals, and does not affect the novelty of the invention claimed." The decision of the Court of Appeals in the suit at bar and respondent's contentions are in entire accord with the above-quoted comment on the Haynes patent. The claim in issue before the Privy Council (quoted above, and appearing at the bottom of page 752 and top of page 753 of the Transcript) specified the invention as the addition of acid to the mixture of ore, water and oil. Haynes made no mention of acid and hence, as stated by Lord Parmoor, the Haynes patent "does not affect the novelty of the invention claimed" by Elmore. But, as stated by Lord Parmoor, the Haynes patent is "an indication of the date at which attention was first directed to the affinity of oil for metals." The Haynes patent indicates that this phenomenon was known as early as 1860. Neither the Court of Appeals nor Respondent has ever said or been under the impression that Haynes disclosed the use of acid. There is not the slightest color of justification for the assertion that there is any variance between the opinion of the Court of Appeals and the judgment of the Privy Council in their interpretation of the Haynes patent.

Lord Parmoor next gives consideration to the claims of the Everson United States patent (Transcript, page 749), which, he says, were published in New South

Wales in 1886 but that the specification was not published, and that inasmuch as reference could not be made to the specification it was difficult to say that the claims gave any information of practical value. Of course, Lord Parmoor was correct in this statement. Everson's claims, like most patent claims, are mere abstract statements without the recital of practical details, and were drawn in this form, as is customary, for the purpose of covering the abstract idea of the invention without limiting it to any particular practical details. In the case before the House of Lords the complete Everson patent was in evidence (Transcript, page 748), and the House of Lords held that Everson anticipated and invalidated the Elmore patent. (Petition for writ of certiorari, page 45.) In the case at bar the entire Everson patent, including the full description contained in the specification, is in evidence. Surely there is no ground for imputing any variance as regards the Everson patent in view of the fact that the Privy Council had before it but the merest fragment of the patent, while the entire document was before the Circuit Court of Appeals and in view of the further fact that the question whether Everson anticipated Elmore was not in issue nor even remotely connected with any issue before the Circuit Court of Appeals.

The "Criley and Everson" publication in the Engineering and Mining Journal in 1890 was next considered by Lord Parmoor (Transcript, pages 749 and 750). He remarked that, judging by the experiments made, this process was applicable only in the case of an ore containing carbonates, and that there was no proof that carbonates were found in all Australian ores. In the suit at bar there is proof, as cited at pages 122 to 126 of this brief, that all ores treated by Minerals Separation in Australia do contain carbonates.

In any event there can be no indication of any variance between the Privy Council and the Court of Appeals merely because Lord Parmoor judged from experiments and other evidence introduced upon one issue that the process described in the Criley and Everson publication was limited to ores containing carbonates, while the Court of Appeals upon other and different evidence introduced in a different case upon another and different issue did not make the same comment. As stated upon pages 63 to 66 of this brief, Mr. Nutter, chief engineer for petitioner, admits that with the alleged new process of the patent in suit each ore presents a separate problem, that every conceivable set of conditions must be tried in attempting to adapt flotation to a particular ore and that flotation is still an experimental art. In view of the these facts it does not appear that Lord Parmoor criticised the Criley and Everson publication any more severely than petitioner's chief engineer criticises the process of the patent here in suit. It appears, furthermore, that Lord Parmoor held the evidence regarding the meaning of the Criley and Everson publication to be much vitiated by reason of improper questions put to the expert witness (Transcript, page 750, near the top of the page). In view of the differences in the issue and in the evidence Lord Parmoor's passing remark that the Criley and Everson publication referred to the treatment of a particular class of ores has no bearing whatever upon the decision of the Court of Appeals.

What the evidence was upon which Lord Parmoor based his statement that from the experiments he judged that the process described in the Criley and Everson publication was applicable only to ores containing carbonates there is nothing in the record of the case at bar to show.

Lord Parmoor next gives consideration to a patent granted to Robson and Crowder in 1894 (Transcript, page 750), but as the Court of Appeals made no reference to this patent comment is unnecessary.

The Froment, Kirby and other prior art processes which are in evidence in the case at bar were not before the British courts for the reason that they were of later date than the Elmore patents and hence not relevant.

The Fryer Hill publication which is here in evidence is not mentioned in the judgment of either the House of Lords or Privy Council and appears not to have been in evidence.

Contradictory Testimony in the British Litigation and in the Suit at Bar.

In the suit which was finally decided by the Privy Council the principal effort of the defendant, The Sulphide Corporation, a licensee of Minerals Separation, Limited, was, as appears from the judgment, to avoid the charge of infringement of the Elmore patent. In furtherance of this effort, the defendant in the British case introduced expert evidence in explanation of the "agitation froth process" which is absolutely contradictory of the evidence introduced by Minerals Separation, Limited, in the suit at bar in their effort to make it appear that the United States patent here in suit is valid. Stated otherwise, one kind of evidence was introduced in the British courts to show that the froth process does not infringe the British Elmore patent, and another and contradictory kind of evidence has been introduced in the suit at bar in an effort to make it appear that the froth process as described in the United States patent here in suit is new and patentable.

As fully set forth on pp. 24, 25, of this brief, the specification and claims of the patent in suit are, according to their express terms, based upon the "preferential affinity" of oily substances for metalliferous mineral as distinguished from the gangue or rock contained in ores. Dr. Chandler, expert witness for Minerals Separation, Limited (Transcript, pages 50 *et seq.*) quotes and endorses the passages in the patent in suit relating to the "preferential affinity" of oily substances and to the coating of the metalliferous particles with oil. Dr. Liebmann, also an expert witness for Minerals Separation, Limited, testified as follows:

> "It is true that the patent in suit makes use of the well-known property of minerals that they have an affinity for oils, whilst the gangue practically repels the oils." (Transcript, page 308, near top of page.)

Now, the Elmore bulk oil process necessarily depends upon the preferential attraction of oily substances for metalliferous matter as distinguished from rock or gangue. It is so stated in the Elmore patents (Transcript, pages 608 and 612). The truth of this explanation as regards the Elmore process was accepted by Dr. Liebmann. (Transcript, pages 258-259.)

But in the British litigation the defendant, desiring to avoid the possibility of being held to infringe the Elmere patent, denied that the "preferential affinity" of oily substances for metalliferous mineral played any part in the froth process, thus flatly repudiating the patent in suit in the case here at bar and flatly contradicting the interpretation of that patent given by Drs. Liebmann and Chandler.

Referring to the judgment of the Privy Council (Transcript, pages 751-753), it will be observed that Lord Parmoor found the Elmore process to depend

upon the selective action of oil, and Lord Parmoor states that respondents (*i. e.*, the defendants in the British litigation) "further contended that the expression 'the selective action of oil" [occurring in the Elmore patent claim] "was referable only to conditions in which the oil is present in sufficient quantities to entrap or coat or absorb the metallic particles, and is of sufficient tenacity to carry these particles in the process of separation, whether by buoyancy or in the form of oil globules." Lord Parmoor then continues with the statement that "Their Lordships are of opinion that this contention of the respondents is well founded" (Transcript, page 753, below the middle of the page). Near the bottom of the same page (Transcript, page 753) Lord Parmoor defines the Elmore invention as "the enhancement of the action of oil, as a selective agent, by the addition of a small quantity of acid to the oil or water in any process of separation in which the oil is adequate in quantity and of sufficient tenacity to entrap or coat mineral particles in a watery pulp, and to hold or carry such particles until separation is effected." So interpreting the Elmore invention, Lord Parmoor stated that there was no anticipation and that the invention was novel and useful (Transcript, page 754, top of the page). Lord Parmoor, as above stated (*supra*, pp. 78, 79), could hardly have held otherwise. The description contained in the specification of the Everson patent was not before the Privy Council; only the claims were in evidence. In the other British case the entire Everson patent was before the court and the House of Lords held the Elmore patent invalid by reason of Everson's prior disclosure of the use of acid. (Judgment of the House of Lords as printed in the petition for writ of certiorari, page 45, paragraph at middle of page.)

Lord Parmoor next proceeds with the question of infringement and in his analysis of this subject he sets forth the position assumed by respondents (defendants) with regard to the operations involved in the froth process, and we quote the following passages from his discussion:

> *"The respondents, however, alleged that their process could work with practical utility without any admixture of oil."* (Transcript, page 754, folio 1358.) (Italics ours.)
>
> *"The respondents deny that they in any way use the appellants' invention, and say that their process is essentially distinct, and that its successful operation depends on the law of surface tension."* (Transcript, pages 754, 755, passage beginning at bottom of page 754.) (Italics ours.)

Commenting upon Professor Pollock's testimony Lord Parmoor expressed himself as follows:

> "The importance of Professor Pollocks' evidence is that he shows that surface tension might account for the success of the respondents' process, to this extent displacing any inference that the addition of an acid to a mixture of oil and watery pulp in a process of separation necessarily implies the use of the invention of the appellants." (Transcript, page 755.)

After commenting further on the nature of the process practiced by respondents in the case before the Privy Council, Lord Parmoor summarized Professor Pollock's testimony and stated the conclusions and judgment of the Privy Council as follows:

> "There is no doubt a difference in the views of the respective experts whose standing and experience entitle them to great weight and authority; but in deciding between these views their Lordships accept the evidence of Professor Pollock to be found in question 5780 and the following questions. This evidence may be summarized as follows: *Professor Pollock is referred to his earlier evidence, and states that*

he does not think that the small quantity of oil introduced in the defendants' process necessarily performs any other function than permanency in the froth and extremely minute emulsion. He allows that there may be oil in excess, and that some of the particles may get oiled, but states that this is entirely and absolutely unessential. He does not, however, think that more than the necessary quantity of oil is introduced to effect concentration, but that having regard to the nature of the problem it is a matter of conjecture, and exact calculation is not possible. *Finally he reiterates his opinion that the defendants' process can be accounted for without assuming selection of the metallic particles by oil. Applying this evidence, their Lordships find that the respondents do not either directly or indirectly use the invention claimed by the appellants, but a process essentially distinct, and that there is no infringement."* (Transcript, pages 755 and 756.) (Italics ours.)

Summary of the Relation Between the British Litigation and the Suit at Bar.

The British suits were brought upon two Elmore patents. The process described in the first of these patents is what is known as the bulk oil flotation process, in which a floating layer of from one to three tons of a thick and viscous oil is used for each ton of ore, and in which there is very gentle agitation having the result of causing the metallic mineral particles to be entrapped in and floated by the oil, the entrapping of the metallic mineral in the floating oil being due to the selective adhesion or preferential affinity of the oil for the metalliferous particles as distinguished from the rock or gangue particles. The suits were withdrawn as to this first Elmore patent. The second Elmore patent was directed to the idea of adding acid in the practice of the process set forth in the earlier patent, the addi-

tion of acid being for the purpose of increasing the preference of the oil for the metalliferous mineral.

The act of alleged infringement complained of was the practice by Minerals Separation and its licensee, The Sulphide Corporation, of the process set forth in the United States patent No. 835,120 here in suit.

United States patent No. 835,120 is by the language employed in the specification and claims, and as understood and explained by Dr. Liebmann and Dr. Chandler, expert witnesses for Minerals Separation, Limited, explicitly limited to a process in which a fraction of 1 per cent. of oil by weight relative to the ore treated is used and in which the oil functions by virtue of its preferential affinity to coat the metalliferous mineral particles as distinguished from the rock or gangue particles.

In the British litigation the issues were, first, whether the Elmore patents were valid; and, second, whether the practice of the "agitation froth process," which is the process described in United States patent 835,120, here in suit, was an infringement of the Elmore patents, and as the actions as to the first Elmore patent were withdrawn in the lower courts the issue as finally decided concerned merely the questions of validity and infringement of the second Elmore patent, which claimed merely the idea of using acid to enhance the preferential affinity or selective adhesion of the oil used.

In the suit at bar the issue is not even remotely related to the Elmore patents. Respondent's expert witness Dr. Byrnes expressly repudiated the idea that the Elmore process bore any similarity to the process described in United States patent 835,120. He said the Elmore patents "relate to the flotation of mineral by oil *per se,* rather than gas" and that "the flotation processes described in these Elmore patents do not rely

on aeration or the evolution of a gas." (Transcript, page 121.)

The finding of the British courts that the process described in United States patent 835,120 is different from and not an infringement of the Elmore process is in strict accord with the position that respondent in the suit at bar has assumed throughout this case, is in strict accord with the evidence introduced in his behalf and in strict accord with the findings of the Court of Appeals.

The Elmore process is unique in the art. No one besides the Elmores, either before or since the date of the Elmore patents, ever proposed or suggested the idea of using from one to three tons of oil for the concentration of a single ton of ore. Throughout the trial and prosecution of the suit at bar Minerals Separation, Limited, has endeavored to vitiate the prior art patents and publications by testimony and argument to the effect that these prior art patents and publications disclose nothing more nor less than bulk oil processes of the Elmore type. But the Court of Appeals found that the prior art processes were not of the Elmore type but were of the type of the process set forth in the patent in suit. This was in strict accord with the findings in the House of Lords and Privy Council that the process described in United States patent 835,120 is different from and not an infringement of the Elmore process. Following we quote from the opinion of the Court of Appeals their discussion of the relation of the Elmore process to the prior art and to the patent in suit:

> "But it is said that the appellees' process is the only froth process, and that the processes described in the prior art are the bulk flotation or oil buoyancy process. We have to inquire, therefore, what is the oil buoyancy process? It is described in the Elmore patents, No. 676,679, issued June 18, 1901,

and No. 689,070, issued December 17, 1901, and in the testimony of Mr. Ballantyne, General Patent Counsel of the Appellees. Mr. Ballantyne said that it was essential to this process, first, that the oil should be thick and viscous, for otherwise the metal would easily fall out of the oil; second, that the process be carried out in the cold, because if the oil be heated, it becomes thin, and will not entrap or float the mineral; third, that the mingling of the pulp and the oil be as gentle as possible, so to avoid breaking the oil into globules. And the appelles' expert, Dr. Chandler, testified that in the oil bulk flotation, 15.7 parts of oil must be used to 6.7 parts of ore. With these definitions and explanations of the oil buoyancy process in view, it is very plainly to be seen that in none of the patents herein discussed, aside from the Elmores', is that process used. The Haynes patent uses 11 per cent. of oil to the ore, and directs that the mixture be agitated with hot, warm or cold water. Kirby recommends thorough agitation by rapid rotation of the agitator, and he refers to the floating concentrate as a 'scum.' The Everson patent declares that thorough agitation of the mass or pulp, comprising water, the finely divided ore, the oil or fat and the acid, is necessary, and in the Engineering and Mining Journal of November 15, 1890, there is an article describing a test operation of that process, in which it was said that as the result thereof 'a thick scum of sulphurets rose to the surface and was skimmed off, leaving the hitherto black ore as white as snow; in fact, pure silica.' " (Transcript, page 720.)

In the judgment of the House of Lords the Lord Chancellor found that the Elmore patent, which was merely for the use of acid in a mixture of oil, water and ore, was anticipated by the Everson patent, but this did not involve any holding, even by implication, that the Everson process is a bulk oil process of the Elmore type, for the Lord Chancellor expressly based his finding upon the fact that the Elmore patent "is so wide in its claim that it includes any mixture whether

in a stiff mass or in a flowing pulp, with more water or with less." (Judgment of the House of Lords, page 45 of petition for writ of certiorari.)

In the suit at bar the sole issues are the questions of validity and infringement of United States patent No. 835,120. The British courts did not have before them the questions of validity or infringement of any patent whatsoever upon the process described in United States patent No. 835,120, but were concerned solely with the question whether the practice of the process which is described in United States patent No. 835,120 infringed the Elmore British patent and the question whether the Elmore British patent was valid or invalid. Not only is it true that the Court of Appeals made no finding at variance in the slightest degree with the judgments in the British cases, but the Court of Appeals could by no possibility have made a decision at variance with the judgments of the British courts for the simple reason that the Court of Appeals and the British courts did not decide the same or even similar issues.

Summary of Contradictory Evidence in British Litigation and Suit at Bar.

The only variance or inconsistency between the British litigation and the suit at bar lies in the fact that the Minerals Separation, Limited, and its licensee used one kind of evidence and arguments for the purpose of escaping the charge of infringement of the British and Australian Elmore patents, and introduced other and contradictory evidence and arguments in their attempt in the suit at bar to maintain the validity of the United States patent here in suit.

In the British litigation evidence was introduced that the Minerals Separation "process could work with prac-

tical utility without any admixture of oil." (Transcript, page 754; *supra*, page 84.)

In the United States patent in suit the only process disclosed is one involving the use of "oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue" (Transcript, page 475), and Dr. Liebmann testified that the process of the patent in suit does in fact depend on the affinity of oils for metalliferous mineral as distinguished from gangue. (Transcript, page 308; *supra*, page 82.)

Professor Pollock, in the British litigation, completely repudiated the idea of the preferential affinity of oils for metalliferous matter as having anything to do with the Minerals Separation process. He also testified that he did not think that oil in the Minerals Separation process "necessarily performs any other function than permanency in the froth and extremely minute emulsion" (Transcript, page 755, bottom of page; *supra*, pages 84, 85), and that the Minerals Separation process "can be accounted for without assuming selection of the metallic particles by oil" (Transcript, page 756, near top of page; *supra*, pages 84, 85).

According to the terms of the specification of United States patent No. 835,120, here in suit, the process is dependent upon the use of less than 1 per cent. of oil by weight, relative to the ore treated (Transcript, page 475, last paragraph), and Dr. Chandler, after quoting the passage referred to, testified that "This discovery is the foundation of the invention described and claimed in this patent" (Transcript, page 51, near top of page).

Professor Pollock in the British litigation repudiated the idea that there was any virtue in using less than 1 per cent. of oil. After stating that the only function of oil in the Minerals Separation process is permanency in the froth and minute emulsion, Professor Pollock

"allows that there may be oil in excess, and that some of the particles may get oiled, but states that this is entirely and absolutely unessential" (Transcript, bottom of page 755, and top of page 756, *supra*, page 85).

And Lord Parmoor expressly states that "their Lordships accept the evidence of Professor Pollock" (Transcript, page 755, near the bottom of the page), and that "applying this evidence, their Lordships find that the respondents do not either directly or indirectly use the invention claimed by the appellants, but a process essentially distinct, and that there is no infringement" (Transcript, page 756, near the top of page).

In England, where Minerals Separation, Limited, and their licensee are sued for infringement of the Elmore patent for the use of acid in a process in which the use of oil and the utilization of the preferential affinity of oil for metalliferous mineral are vital elements, Mineral Separation says that their process will operate without any oil at all; that if oil is used its preferential affinity for metalliferous matter plays no part whatever; and that if an excess of oil is used some of the particles may get oiled, but "that this is entirely and absolutely unessential."

In the United States, where Minerals Separation, Limited, owns a patent upon a flotation process based upon the use of oil, upon the utilization of the preferential affinity of oil for metalliferous matter, and upon the allegation contained in the patent that it is vital to the success of the process that less than 1 per cent. of oil be used, Minerals Separation denies all the allegations made in England and says that oil must be used; that its preferential affinity is utilized; that less than 1 per cent. of oil must be used, and that an excess of oil brings about an altogether different and useless result.

Underlying Causes of Flotation.

The general principles underlying the Elmore bulk oil flotation seem quite clear. The process is well illustrated in the experiment described by Mr. Chapman, metallurgist for Minerals Separation, Limited. He described the procedure as follows:

> "I took a glass cylinder that would hold 1200 cc. of water and in this placed 100 grammes of crushed ore. To the ore would be added 600 to 800 cc. of water. Upon this would be placed 100 grammes of thick residuum oil. The stopper would be placed in the cylinder and the cylinder was then gently tipped or revolved in a vertical direction. I would exercise great care not to break up the oil which would bring almost a frog's spawn effect. After about thirty tips, that is to say, fifteen vertical revolutions of the cylinder, I would let the water pulp settle. I would then draw off the oil by means of a spatula and transfer this to a basin. An examination of the tailings would show whether a good recovery of the sulphide content had been obtained. If this showed the presence of sulphide mineral I added a further 100 grammes of oil and resumed the tipping. After another thirty tips I would stop the test and draw the oil off as before. If necessary this would be carried out three times." (Transcript, page 197.)

We illustrate the operation described by Mr. Chapman in the accompanying sketch.

Fig. 1 represents the ingredients in the bottle as described by Mr. Chapman. Fig. 2 shows the bottle after being tipped. Upon tipping or inverting the bottle the water immediately finds its way to the bottom and the oil to the top, as shown in Fig. 2, but the finely powdered ore, though heavier than either the oil or water encounters the thick oil, and as indicated in Fig. 2 the metalliferous particles in the ore stick in the oil and are floated by it

Elmore Bulk Oil Process

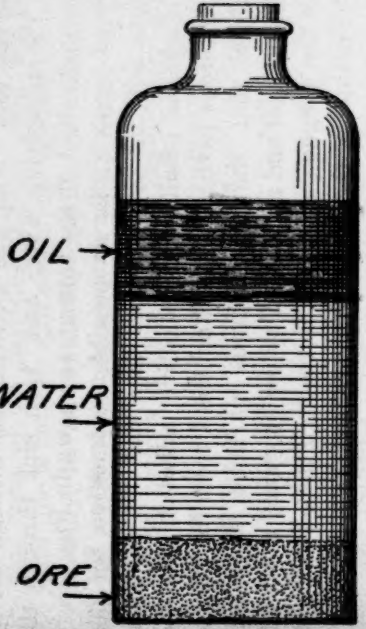

Fig 1

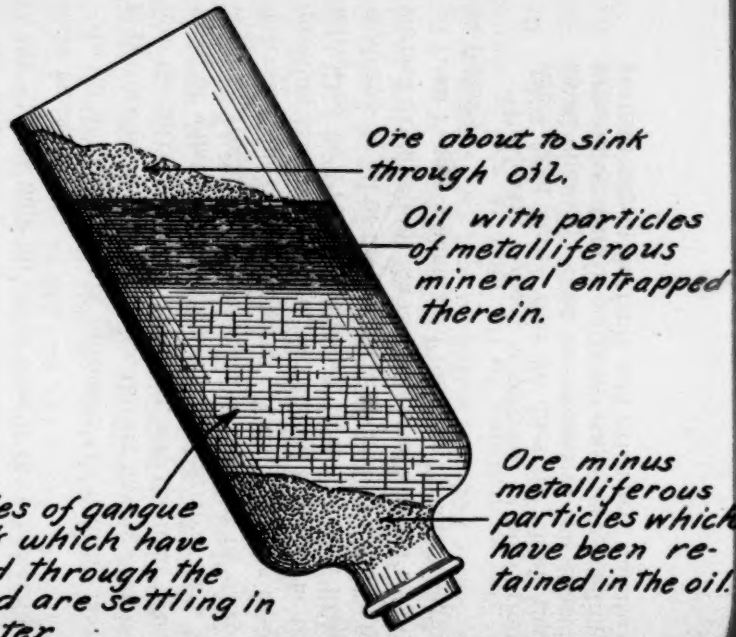
Ore about to sink through oil.
Oil with particles of metalliferous mineral entrapped therein.
Ore minus metalliferous particles which have been retained in the oil.
Particles of gangue or rock which have slipped through the oil and are settling in the water.

Fig 2

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while the rock or gangue particles fall through the oil into the underlying water and then sink through the water and collect at the bottom, as shown in Fig. 2.

There seems to be no possible explanation for this Elmore bulk oil process other than that the oil has a "preferential affinity" or selective adhesion for the metalliferous particles as distinguished from the gangue particles, that the metalliferous particles, therefore, stick in the oil and are floated by the buoyancy of the oil, while the gangue particles drop through the oil and sink to the bottom of the underlying water.

But in the process of the patent in suit and in the prior art processes the amount of oil used is far too little to float any appreciable amount of mineral by its buoyancy; in many of these processes the oil used is thin and would not hold the metalliferous mineral particles; and in all of the prior art processes the agitation would be fatal to the Elmore bulk oil effect even if the other conditions were suitable.

In all of the prior art processes the floating material is permeated with air bubbles, the air having been beaten into the mixture by the agitation, and the float takes the form of what would ordinarily be described as a foam, scum or froth. The buoyancy of the float is, of course, derived from the air bubbles. This being the case, the question arises as to what part the oil plays. The theory advanced by Professor Pollock in the British litigation conforms to all of the known facts and appears to be the correct explanation. In the judgment of the Privy Council Lord Parmoor sums up Professor Pollock's testimony as follows:

> "Professor Pollock is referred to his earlier evidence, and states that he does not think that the small quantity of oil introduced in the defendant's process necessarily performs any other function than permanency in the froth and extremely minute emul-

> sion. He allows that there may be oil in excess, and that some of the particles may get oiled, but states that this is entirely and absolutely unessential. . . . Finally, he reiterates his opinion that the defendant's process can be accounted for without assuming selection of the metallic particles by oil." (Transcript, bottom of page 755 and top of page 766.)

Professor Pollock's views are contradictory of the patent in suit and of the witnesses for Minerals Separation, Limited, in the suit at bar, but are in accord with the testimony of Mr. Hyde and Dr. Byrnes, who was Mr. Hyde's expert witness. Both Mr. Hyde and Dr. Byrnes testified regarding experiments in which they formed concentrate froths with amounts of oil varying from less than 1 per cent. to 25 per cent. by weight relative to the ore treated. This is in accord with Professor Pollock's testimony, above quoted (*supra,* p. 85), that an excess of oil is unessential. Mr. Hyde's and Dr. Byrnes' experiments are referred to, with citations to the Transcript, on pp. 46, 47, 146 to 149, and 185 of this brief. Professor Pollock's testimony on this point is also in harmony with the testimony of Mr. Higgins, metallurgist for Minerals Separation, Limited, who obtained the froth characteristic of the patent in suit by using 3.6 per cent. of oil in treating the Elm Orlu ore (Transcript, page 387, also pages 47 and 154 of this brief). This record shows beyond the possibility of doubt that the froth results from the use of much more than 1 per cent. of oil as well as from less than 1 per cent. and Professor Pollock testified to the same effect in the British litigation in saying that an excess is unessential.

Professor Pollock's statement that the function of oil is to give permanency to the froth is also in accord with the testimony of Dr. Byrnes in this case. Dr. Byrnes performed seven experiments to illustrate the effects of the different substances used in flotation. Dr.

Byrnes' description of these experiments begins near the bottom of page 103 of the Transcript, and extends to page 105. In the first experiment he half (this word is erroneously printed as "held") filled a test tube with water and then corked and agitated it. Dr. Byrnes says that the air in the tube was shaken into the water in the form of fine bubbles, which, however, quickly rose to the surface and escaped when the agitation was discontinued. The second experiment was a repetition of the first with the difference that one drop of red oil, which is impure oleic acid, was first added to the water. Dr. Byrnes says that in this case the fine bubbles of air entangled in the water by agitation remained distributed throughout the water for a considerable period, giving it a milky appearance. There was no ore in the mixture in either of these experiments. The fact that in the second experiment the bubbles remained in the water for a considerable period while they quickly escaped in the first experiment, is in direct line with Professor Pollock's testimony that the function of the oil is to give permanency to the froth. And, as shown by the testimony, practically any amount of oil serves this purpose, although the use of an unnecessarily large amount is wasteful.

As above stated, Lord Parmoor, in the judgment of the Privy Council, referred to the fact that the respondents (defendants) in that case "alleged that their process could work with practical utility without any admixture of oil." This evidence was of value to defendants in the British litigation as going to show that there was no infringement of the Elmore bulk oil process, and apparently the position was well taken as the Potter process in which no oil is used has been applied extensively in Australia. The Potter process is described in the Potter United States patent No. 776,145 (Tran-

script, page 643). Potter describes his process as follows:

> "The crude ore, concentrates, tailings or slimes after being pulverized are placed in a suitable vat or vessel and a solution is then added, such solution consisting of water with the addition of from 1 per cent. to 10 per cent. of any acid (preferably sulfuric acid, for reasons hereinafter stated), the acidulated strength of the solution being determined by the quality or nature of the sulfid ore to be treated. The small quantity of acid added does not act as a solvent.
>
> "Ores containing lead, zinc, copper, iron, gold, and silver in combination with sulfur I treat as follows: The ore in a state of fine division is placed in a vat or such like vessel provided with an internal stirrer or stirrers. . . . Heat being applied, the effect of the acidulated solution becomes apparent by the bubbling up and gathering on the surface of the fluid of the metallic concentrates in the form of a pasty mass." (Transcript, pages 643-644.)

Potter then goes on to discuss the amount of acid to be used in the solution and the amount of solution to be used per ton of ore, and adds that "the stirrers are then freely used" and heat applied, whereupon the metals rise and float.

With reference to the Potter process, Dr. Byrnes testified as follows:

> "United States patent No. 776,145, granted November 29, 1904, to Charles V. Potter, discloses a process similar to that of Delprat patent No. 735,071, except that the pasty mass containing the metallic concentrates which is removed by overflow or skimming is formed by the action of sulfuric acid, stirrers, which 'are freely used,' and heat, which might be that of steam injected into the agitating vessel at or near its bottom. The agitating vessel illustrated in the drawing of the Potter patent 776,145, consisting of a vertical shaft carrying four radial stirrer arms at its lower end and rotated by

> gears at the upper end, is practically identical with that used by defendant in this suit, and shown by him in his recent United States patent No. 1,022,085. The free use of such an agitator causes the solution to become thoroughly aerated and impregnated with the air bubbles which would assist the gas chemically generated in forming a pasty floating mass carrying the concentrates." (Transcript, page 100.)

Both Mr. Chapman and Mr. Herbert C. Hoover testified to the practical use of the Potter process in Australia. (*Supra*, pages 54, 55.)

Dr. Liebmann has testified that in the Potter process the agitation must be gentle, that the agitation does not introduce any air bubbles and that the flotation is due to carbonic acid gas generated by the action of the acid upon the carbonates, which he says are present in most ores, and he describes a demonstration of the Potter process performed by him. (Transcript, pages 259, 260.) But there is nothing in the Potter patent to indicate that the agitation is any different from that spoken of in the patent in suit, and nothing to indicate that the Potter process is any more dependent on carbon dioxide gas. As set forth at a later point in this brief (pp. 122 to 126) the Australian ores operated on by Minerals Separation, Limited, contained from 1 to 3 per cent. of calcite, and Minerals Separation used about 1 per cent. of sulphuric acid. The Potter process was applied to the same ores and the amount of carbonic acid gas generated could not have been much greater even if Potter did in some instances use more sulphuric acid.

Potter's process is an example of a prior art process in which no oil was used. In the British litigation the defense was made that no oil was necessary in the Minerals Separation process, which defense was an admission of the identity in principle between the Minerals Separation process and the earlier Potter process.

Irrelevant Matters Introduced in Evidence by Petitioners.

Petitioners during the trial introduced a considerable volume of irrelevant testimony bearing upon matters not related to the issues of the case. The irrelevant subjects referred to are Respondent's former employment by Minerals Separation, Limited, the construction of an experimental apparatus referred to as a "slide mach[illegible]," and the reason which impelled defendant to examine and subsequently operate upon the Butte zinc ore.

Defendant's Employment by Minerals Separation, Limited.

Complainants alleged in their bill of complaint that prior to defendant's alleged infringing acts he had been in the employ of Minerals Separation, Limited, one of the complainants, for a period of about one year, and that defendant while thus employed was instructed by the engineers and experts of Minerals Separation, Limited, "in all technical details and particulars as to the said letters patent No. 835,120, and the installation and use of the process of ore concentration constituting said invention." (Fifth paragraph of bill of complaint, Transcript, page 4.) The only relief prayed for is an injunction against infringement of the patent and the recovery of damages and defendant's profits growing out of past infringements. Such information as was imparted to defendent by Minerals Separation, Limited, can in no wise affect the validity of the patent in suit or the question of infringement. The patent can be valid only if, as required by the statute, the inventor has described therein a "new and useful art, machine, manufacture, or composition of matter" (Sec. 4886, R. S.), "in such full,

clear, concise, and exact terms as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound and use the same." (Sec. 4888, R. S.) If information given to defendant by Minerals Separation was necessary to enable him to carry out his operations at Basin, the necessity or value of such information could have arisen only by reason of the failure of the patent to disclose an operative process and operative means for putting that process into practice, which defect would in itself render the patent invalid. If, on the other hand, defendant was merely given some superfluous and unnecessary information not set forth in the patent, the matter is impertinent and scandalous in that the only issues of this suit are the validity of the patent and the question whether defendant's acts fall within the scope of the protection granted thereby.

The "Slide Machine."

Complainants have presented a large amount of testimony regarding the authorship of a small experimental machine, termed the "slide machine," designed for carrying out experimental flotation operations on a small scale. This "slide machine" is not described or referred to in the patent in suit and was not designed or made until 1909, years after the grant of the patent in suit. The slide machine is not patented. Mr. Hyde stated that he and Mr. T. J. Hoover, general manager of Minerals Separation, Limited, discussed various ways of making an experimental apparatus, and that "Mr. Hoover suggested that it should be possible to divide a machine into an upper and a lower portion and slide off the upper portion over a proper guide." (Transcript, page 79, bot-

tom of page.) Mr. Hyde testified that the machine, when constructed, was modified in minor features under his supervision. The machine is a mere accessory for experiments. Mr. Ballot (Transcript, page 163) says that such a machine is not necessary for tests, but that it is very convenient. It seems that Mr. Picard testified that the first slide machine was made by him (Transcript, page 250), and by him sent to Mr. T. J. Hoover, who said that he would use it as the standard for test machines. Improvements were made on the machine as designed by Mr. Picard (Transcript, page 208), and Mr. A. C. Howard, works manager of Minerals Separation, Limited, admits (Transcript, page 209) that "Mr. Hyde probably did something as to minor alterations of the apparatus after the first tests were made." It appears, therefore, that the record indicates that Mr. Hyde was mistaken in attributing the authorship of the machine to Hoover. The entire circumstance is inconsequential, and we are impelled to refer to it only by the fact that complainants seem to have shown a disposition to make an unjustifiable attack on Mr. Hyde's character.

Reason for Defendant's Operations at Butte.

Complainants have attempted to make it appear that defendant's operations at Butte resulted from his having learned, while in the employ of Minerals Separation, Limited, of the existence of zinc mines at Butte. The matter is, of course, irrelevant, and has no bearing upon the issues of this suit. Following, however, is a statement of the facts:

After the termination of his contract with Minerals Separation, Limited, Mr. Hyde was engaged by Mr. Herbert C. Hoover as a mining engineer in connection with

some Alaska and other properties in which Mr. Hoover was interested. (Transcript, page 171.) Mr. Herbert C. Hoover and Mr. Hyde went to New York, and on arriving there Mr. Hoover became interested in the refinancing of the Butte & Superior Copper Company, whereupon he directed Mr. Hyde to co-operate with a Mr. Kuehn in an examination of that property. By the time Mr. Hyde made his report Mr. Hoover had lost interest in the Butte & Superior proposition, and he told Mr. Hyde he could do as he liked in connection with that matter. (Transcript, page 171.) Mr. Hyde thereupon commenced the operations on the Butte & Superior ore upon which this suit is based. (Transcript, page 82.)

THE PRIOR ART IN DETAIL.

Haynes British Patent No. 488 of 1860 (Transcript, Page 523.)

In this patent Haynes describes a process in which he mixes the powdered ore with what he terms his "agent," consisting of coal tar, resin, fatty or oleaginous substances, or other materials named in his patent. In his process as described in the specification of his patent he added one part of his "agent" to "five to nine parts of the powdered ore" and agitated the mixture in a mixing machine, added water, then continued the treatment either in the mixing machine or in a triturating machine, whereupon "the separation of the metals from the other portions of the ores or matrices commences." He states that then "I remove such earthy or foreign matter, and replace it by fresh ore or matrix, and repeat this till I find my 'agent' will take up no more metal." (Transcript, pages 524, 525, paragraph beginning a little below the middle of page 524.)

Haynes states that he crushes the ore fine enough to pass through a sieve of 100 meshes to the lineal inch. (Transcript, page 525, lines 15, 16.)

After stating that he applies the "agent" to the finely divided ore "by mixing the ore and agent together in a 'mixing machine'" (Transcript, page 525, bottom of page), he says:

> ". . . I add, as circumstances may require, either hot, warm or cold water sufficient to well cover the whole, as hereinbefore referred to. Whereupon the agitation being still kept up, the agent acts upon the metal and gradually effects the separation of the metal from the earthy or non-metallic matters of the ore or matrix, or ore and matrix, the earthy matter sinking to the bottom of the water, and the metal being retained by the agent . . ." (Transcript, page 526, top of page.)

In the passage above quoted Haynes says that the earthy matter sank to the bottom. Obviously, the metalliferous matter must have floated. There would have been no separation if the metalliferous matter had sunk with the earthy matter.

Further proof that the metalliferous matter floated in the Haynes process is found in the following statement made by him immediately after the passage last above quoted:

> "To remove the agent from the metal, I put the agent and metal still in union in a vessel containing an alkaline solution, for instance, a strong solution of caustic soda in water, and in a short time the metal is precipitated to the bottom, and may be removed." (Transcript, page 526.)

The statement that "the metal is precipitated to the bottom" shows conclusively that when the metal with the adhering agent is separated from the earthy matter and placed in an alkaline solution the metal at first

floats, and is only "precipitated" or caused to sink by the action of the alkaline solution.

The patent in suit (Transcript, page 476, last four lines of page), like Haynes, recommends the removal of the oil (oleic acid is the oil mentioned in the patent in suit) by means of an alkali. The patent in suit, like Haynes, recommends the use of a mixing apparatus which is imperfectly illustrated and described in the patent, but which complainants' witnesses say represents a "Gabbet" or "cone-mixer" of a kind in use and on sale in England.

Haynes used one part of his "agent" to from five to nine parts of ore. One part of "agent" or oil to nine of ore would be 11 per cent. of oil to ore by weight.

He floated the metalliferous mineral.

He removed the gangue or tailings which sank to the bottom, and added more ore until no more would float.

These additions of ore necessarily reduced the percentage of oil to the lowest point at which additional flotation could be secured.

The Haynes patent contains a description of everything specified in the claims of the patent in suit, with the single exception of the use of acid, which is mentioned in claims 2, 3, 6, 7 and 11. The treatment of powdered ore in water with oil, the agitation of the mixture, the fact that the metal is retained by the oil, or "agent," as Haynes terms it, and remains in combination with it, the use of heat, the separation of the metal by reason of the fact that the earthy matter sinks, which necessarily implies that the metal and oil float—all this is plainly set forth by Haynes.

The instruction of the patent in suit to use less than 1 per cent. of oil adds nothing to the knowledge of the engineer, who only exercises the skill of his calling in accomplishing the desired result in the most economical

manner. The 11 per cent. of oil with which Haynes started his operation could not possibly have brought about the flotation in any other manner than as a result of the inclusion of air caused by the agitation described by him. Minerals Separation's witnesses and employees say that to produce flotation by the buoyancy of oil unassisted by air or other gas it is necessary to use from two thousand to six thousand pounds of oil per ton of ore. (*Supra*, pages 8 to 20.) Haynes' 11 per cent. of oil is 220 pounds per ton of ore —from one-tenth to one-twenty-seventh of the amount necessary to produce flotation by the buoyancy of the oil unassisted by air or gas bubbles, and even this proportion of oil Haynes reduced to the lowest possible limit by adding more ore until no more metalliferous mineral would float.

Everson U. S. Patent 348,157 (Transcript, page 579).

The second notable discovery in the art of oil flotation concentration is set forth in the Everson patent, which was granted in the year 1886. As stated by William H. Ballantyne, a metallurgist and patent solicitor, who testified for his client, Minerals Separation, Limited, "Everson's process differs from Haynes' process in that the water is acidified." (Transcript, page 221, near top of page.) Everson in her patent makes the following statement regarding the use of acid:

> "When petroleum or a constituent thereof is used the oil should desirably be first mixed with the ore, then water added containing a suitable amount of free acid or a soluble neutral or acid salt, the quantity of water being ample for the washing-out operation, which is to follow, and the quantity of acid sufficient to cut the sand away from the otherwise cohering mass." (Transcript, page 581.)

Complainants' witness Ballantyne refers to the Everson patent "as showing the origin of the remarkable fact that acidified water has a greater wetting power for gangue than neutral water." (Transcript, page 221, lines 9, 10 and 11 from bottom of page.)

In the passages quoted below from the Everson patent the patentee sets forth the nature of the invention, and some of the reagents suitable for putting it into practice:

> "The discovery which forms the basis of my invention is that metals and metallic substances in a comminuted state will unite with compounds of fats or oils and acids, and that such compounds will not unite with comminuted quartz or other rocky gangue. The essential feature of the method which constitutes my invention, therefore, consists in commingling with pulverized ore a fat or an oil, either animal, mineral or vegetable, or a fatty constituent or acid of an animal or vegetable fat or oil, or any constituent of a mineral oil, together with an acid, either mineral or vegetable, or a soluble neutral or acid salt for the purpose of effecting a union of the free metal or metallic portion of the ore with such admixed material, whereby the same may be retained in the subsequent separation of the quartz or other rock therefrom by washing, or other suitable means. (Transcript, page 579.)
>
> . . . . . .
>
> "In putting my invention into practice any fat or oil, and any acid, either mineral or vegetable, or any soluble neutral or acid salt, or any compound of fats and oils with appropriate acids, may probably be successfully employed, at least such is the case with all of these agents with which I have so far experimented. I have used petroleum and one of its several constituents—namely, paraffine oils—also tallow, (melted), lard, lard-oil, red-oil, (impure oleic acid), cotton-seed oil, castor-oil, sperm-oil and linseed-oil, and some combinations of these with each other. The acids which I have employed are sulphuric, hydrochloric, nitric, phosphoric, acetic,

oxalic, tannic, and gallic." (Transcript, page 580.)

Following the statement above quoted, Everson gives specific descriptions of two methods of applying her process.

According to the first method (described in the paragraph extending from the lower part of page 580 of the Transcript to page 581) a mixture of cotton-seed oil, sulphuric acid and water is added to a powdered ore having a quartz gangue and thoroughly stirred therewith, forming a stiff mass, which mass is then in condition for the washing out of the quartz by the action of water. In the washing operation the mass is broken up and stirred in water in a vessel provided with a mechanical stirrer and having an outlet or outlets at the bottom for the escape of the water and sand. The patentee states that the concentrated mineral will accumulate in a pasty mass. In connection with the first method she does not say how she removes the concentrate, although obviously it is not by its sinking or settlement, as she removes the water and sands through outlets in the bottom of the vessel. Neither could she have removed the concentrates by the buoyant effect of the oil, or bulk oil flotation, as it has been termed, for the reason that, as interpreted by Dr. Liebmann, expert witness for Minerals Separation, Limited (Transcript, page 330, lines 4 to 6), the amount of oil used was only about 5 per cent., or one-twentieth of the weight of the ore, while bulk oil flotation requires from 100 to 300 per cent. of oil (pages 8 to 20, *supra*).

According to the second method described in the Everson patent, petroleum, or a constituent thereof, is first mixed with the ore, after which water is added containing a suitable amount of a free acid. The amount of oil recommended by the patentee amounts to about 18 per cent. of the weight of the ore (Liebmann, Transcript,

page 330, line 13). The following are the directions of the patent:

"When petroleum or a constituent thereof is used the oil should desirably be first mixed with the ore, then water added containing a suitable amount of free acid or a soluble neutral or acid salt, the quantity of water being ample for the washing-out operation, which is to follow, and the quantity of acid sufficient to cut the sand away from the otherwise cohering mass. In the case of petroleum or its constituent, paraffine-oil, one or two fluid drams of acid to one gallon of water is sufficient for this purpose. The petroleum which I have used was 30° Baumé, and I have found three fluid drams of oil abundant for properly moistening two ounces of heavy ore, or in the ratio of about a barrel of oil to the ton of ore, the amount being, of course, variable with the relative bulkiness of the ore.

"In the use of petroleum, or of a liquid constituent thereof, like paraffine-oil, the condition of the concentrated mass is more liquid than when a vegetable or an animal oil or a fatty constituent thereof is used, and a somewhat different means or method should be employed for removing the sand. In practice, the concentrate, after thorough agitation of the mass and detachment of the sand, will in this case be preferably *removed by means of a constant overflow* of water from a washing-out vessel, by which overflow *the concentrate will be floated off*. Devices and methods now well known in wet separation of ores will be suited to this part of the operation, bearing in mind that the sand and mineral are merely transposed or their relative positions are reversed, because the sand is heavier than the mixture of mineral, oil, and acid. A proper selection of devices for this purpose will be apparent to those skilled in the wet separation of ores.

. . . . . .

"The proportions in which the acids or salts are added to the oils or fats may vary according to the kind of acid or oil employed, and also according to the kind of ore to be treated; and the manipulation of the substances employed may be varied from that

above set forth in either formula given. These matters may be determined in individual cases by the operator; *and I do not, therefore, restrict myself to any particular proportions of the substances employed,* though I have above indicated proportions of certain acids and oils by one or the other of which practical results may be obtained upon almost all varieties of ores." (Transcript, pages 581, 582.) (Italics ours.)

Dr. Byrnes gives the following account of a test of the Everson process made by him:

"I also carried out the operation of the Everson patent 348,157, by using the Hyde slide machine to effect the thorough agitation of the oiled ore and removal of the sand by means of acidulated water, floating off the concentrates. This Everson process is similar to that of Schwarz, in that the ore is oiled before it is agitated with acidulated water. For this purpose, I employed the materials and proportions specified in lines 75-92 of the patent, using as an acid the sulfuric acid mentioned in lines 8 and 119. I used eight times the amount specified, that is, 16 ounces of the pulverized 'Black Rock' ore, and 24 fluid drams of petroleum, in this instance having a gravity of 33° Baumé. I thoroughly mixed the ore and petroleum, producing a homogeneous mass having the consistency of damp sand. I then placed in the slide machine 1600 cc. of water, acidulated with 3 cc. of sulfuric acid, having a temperature of 27° C. The agitator of the machine was then started and the oiled ore gradually added. The agitation was continued for thirty seconds, producing a good froth, which was removed. The mixture was then reagitated for thirty seconds, and the second froth removed.

"In order to maintain the acidity of the water, to assist in cutting away the sand from the oiled material, as described by Everson, 1 cc. of sulfuric acid was now added. The mixture was then reagitated several times and four froths removed. 1 cc. of sulfuric acid was again added and the mixture was successively reagitated three more times and three froths removed. The nine froths were mixed and

filtered. The residual concentrates were then washed several times with gasoline to entirely remove the oil therein, and were dried and weighed. Their weight was 144 grams. The tailings were nearly white or quite light-colored, the greater amount of the zinc sulfid having been removed therefrom, as was apparent to the eye." (Transcript, pages 106-107.)

In performing his Everson experiment Dr. Byrnes, as above stated by him, removed nine froths, that is, he treated the material nine times in succession for the purpose of extracting as much as possible of the metalliferous mineral from the ore. In commenting upon a similar use of the process of the patent in suit, Mr. Ballantyne, patent solicitor and witness for Minerals Separation, Limited, stated that repeated treatment of the same material by the process of the patent in suit would not be a departure from or an improvement on the process and would not be an inventive idea (Transcript, page 230). This, of course, is elementary, and we refer to it only as showing that Dr. Byrnes applied the Everson process in the intended and natural way.

The experiment described above demonstrates beyond doubt that the Everson patented process leads to the precise result described in the patent in suit.

Dr. Byrnes followed Everson's directions in mixing the oil with the dry ore before adding the acidulated water.

Whether the oil be added to the dry powdered ore or be added to the mixture of ore and water, *i. e.,* to the pulp, is immaterial so far as anticipation of the patent in suit is concerned. The result is the same whether the oil or water be first added to the ore, as shown by the fact that Dr. Byrnes obtained the same float in his Everson experiment referred to above as in his Froment and Kirby experiments (*post,* pages 146 to 149, and 185), in which he added the oil to the mixture of ore and water,

i. e., to the ore pulp. It happens in practice that the ore is generally ground in water, and the oil is therefore generally added after the water as a matter of convenience and not as in any way affecting the flotation process.

Oil-Gas Flotation by the Everson Process.

The thorough agitation and removal of the concentrate by an overflow of water mentioned by Everson are the same means that are described and recommended in the patent in suit for separation of the concentrate. The use of an up-current of water is specifically described in the patent in suit (Transcript, page 477, next to last paragraph on page). Though the amount of oil recommended by Everson is greater than the amount named in the patent in suit, it is important to note that Everson's maximum amount, 18 per cent., of oil is far less than would be required to effect bulk flotation. The Everson process, therefore, must have involved the oil-gas flotation principle, the gas being air introduced into the mixture by the thorough agitation which Everson described. Without the buoyant effect of air or other gas, Everson could not have floated off the concentrate in the manner she describes, owing to the small amount of oil used, and Dr. Byrnes' experiment, described in the foregoing quotation from his testimony, demonstrates the identity in procedure and result between the Everson process and the process described in the patent in suit.

Dr. Byrnes sums up the information contained in the Everson patent as follows:

> "(1) That any fat or oil, including red-oil or impure oleic acid, cotton-seed oil, or petroleum and its constituents, has a selective action or preferential affinity for comminuted metals and metallic substances admixed with comminuted quartz or other rocky gangue.

"(2) That a mineral or vegetable acid, or a soluble neutral or acid salt, such as sulfuric acid or a sulphate tends to effect a union of the metallic portion of the ore with the admixed fat or oil, and to enable it to be retained thereby during the separation of the gangue, the use of both the fat or oil and the mineral or vegetable acid or salt being specified as the essential feature of the method.

"(3) That the material used for oiling the mineral should be sufficiently liquid to enable it to be thoroughly brought in contact with the mineral, and in winter, when it has become solidified, it should be heated to melt and thin it, although in summer temperature such heating may not be necessary; that some of the oils or fats prescribed are solid at ordinary atmospheric temperatures, for example, tallow which the patentee notes should be used melted; that the red-oil, or impure oleic acid, mentioned, ordinarily produced from tallow in separating the stearin, and other harder fats used for candle-making, etc., may be either solid or liquid, depending on the season of the year, whether winter or summer, and that other oils mentioned, cotton-seed, castor, sperm, linseed, and petroleum, are liquid at ordinary atmospheric temperatures.

"(4) That the proportions of oil or fat and acid used must vary according to the kind of each employed and according to the kind of ore to be treated, and must be determined in individual cases by the operator.

"(5) That the operation of concentration as a whole, or in its practical form as applied to the separation of rocky mineral ores, involved the reduction of the quartz or other rock containing the mineral to a powder; that is, fine comminution is necessary to liberate the mineral from the gangue, or produce separate particles of each, enabling the mineral to be preferentially coated with the oily material.

"(6) That thorough agitation of the mass, or pulp comprising water, the finely divided ore, the oil or fat, and the acid, is necessary, the purpose being to bring the mineral into contact with the oil and acid as completely as possible to enable each particle of

mineral to be preferentially oiled; and that the particular apparatus to be used is not described or illustrated, the statement being made that, when using a naturally liquid oil, like petroleum or paraffin-oil, the mass is first thoroughly agitated and the concentrate will then be separated from the sand or gangue by flotation, 'by means of a constant overflow of water from a washing-out vessel, by which overflow the concentrate will be floated off . . . because the sand is heavier than the mixture of mineral, oil, and acid.' As the patentee states that devices and methods of this character are well known in the wet separation of ores, reference is evidently here made to the use of the common spitzkasten, in which a constant current of water lifts the lighter material which floats off, while the heavier portions gravitate to the bottom against the current." (Transcript, pages 97-98.)

Published Descriptions of Everson Process.

The fact that the Everson process did not until a later date, when its principles were adopted by others, result in extensive commercial operations, does not in any way detract from the force of the Everson patent as a clear exposition of the principles which were later utilized. The principles of oil flotation and a proper mode of manipulation were plainly set forth in the Everson patent.

As evidence of the information imparted to the public by Everson's operations there are in the record two publications, the "Fryer Hill Publication" and the Criley & Everson Publication," both describing operations carried out in accordance with her ideas. The first of these publications appeared in the Daily Herald Democrat, of Leadville, Colorado, October 30, 1899, and the second appeared in the Engineering and Mining Journal, November 15, 1890, this later article being a dispatch to the Engineering and Mining Journal from Baker, Oregon, un-

der date of November 10, 1890. These articles are printed upon pages 414-415 of the Transcript. They were referred to in the cross-examination of William H. Ballantyne (Transcript, page 240), a metallurgist, and one of the patent solicitors for Minerals Separation, Limited, who testified on behalf of his client. We quote these articles below:

"COMPLAINANTS' EXHIBIT FRYER HILL PUBLICATION.

"(The 'Daily Herald Democrat,' Leadville, October 30, 1889)

"AN IMPORTANT INVENTION.

"Experiments with the Oil Rotary Concentrator.

"One of the most novel methods of treating dry silicious ore ever brought to notice—An exhaustive review of the new process—Its advantages particularly applied to the miners of Fryer Hill—News from the mines—Shipments from the new quartzite strike—Mikado's new developments.

"Experiments are now being made in Denver with a new appliance for the concentration of dry silicious ores, such as those of the Dunkin, Matchless, Little Silver, and in fact all the mines of Fryer Hill. So far, the experiments have proved a perfect success, the tailings from the concentrator, if so it may be called—only running one ounce to silver from a crude ore that ran over ten ounces of silver per ton. The first unimportant means of testing the new system having proven so incontestably the correctness of the theory, other larger and more capable means have been employed. The whole system of concentration appears to be based on the well known affinity of the lighter forms of sulphuret and chloride of silver for oils. Petroleum is the oil now being used by the parties having these experiments in charge, and appears from its density, to possess the requisite adhesiveness to effect the result desired. The ore is first crushed and rolled to such a degree of fineness as to enable it to pass through a 40 mesh screen, and while dry, is thoroughly mixed with the oil, after which it is placed in a circular tank or receiver, through the center of which runs a rotating hollow tube, to

the bottom of which tube is attached, on two opposite sides, a couple of fans, the lower edges of which are unevenly cut in order to send—in the revolution—the lighter particles of the ore and oil mixture to the outer sides of the drum or cylinder. This rotating hollow tube is perforated at, or near, the bottom, and, when the receiver is thoroughly charged, acidulated (sulphuric acid is used) steam is introduced through the tube and is forced to the bottom of the mixture, while the ar-astre-like fans, attached to the bottom of the tube, keep the whole mixture in motion, and the action of the revolving tube, the fans, and injected acidulated steam causes the lighter portions of the mineral-charged oil to float to a point just above the center of the receiver, where there are suspended two semi-circular doors, which, when the oil has passed above them, laden with its precious freight, are raised, and the superfluous water allowed to drain through slight perforations in the bottoms of these semi-circular doors, after which the mineral-laden oil is carefully removed to settling barrels revolving with jets of steam injected continuously from the lower ends. These settling barrels being placed at an angle, permit the mineral-laden oil to pass through openings in the ends, which are connected with shallow settling tubs or tanks from which the concentrated ore is shipped directly to the smelters, who will hardly be likely to refuse so pleasant an addition to their heating powers. As said above, with the present plant, which is daily being improved upon, a good, high grade concentrate is being (751-32) made on ores on which no previous methods of saving the silver value has proven entirely satisfactory, and the few mining men of Fryer to whom this scheme has been whispered are watching the experiment with a great deal of interest, as there are thousands of tons of such ore now awaiting treatment." (Transcript, page 414.)

"COMPLAINANT'S EXHIBIT CRILEY & EVERSON PUBLICATION.

"No. 15, 1890-581.

"The Engineering and Mining Journal, Oregon, Baker County.

"BAKER CITY, Nov. 10.

"Quite a number of capitalists from Portland and Walla Walla are here watching the result of some test-working of the 'Criley & Everson Oil Process' for the extraction of sulphurets from any ore as the name signifies by the use of oil. Your correspondent witnessed a test made on the Eureka and Excelsior ore which was conducted as follows: The ore was crushed and passed through a 50 mesh sieve, weighed and thoroughly mixed with black thick oil. To water heated to near boiling was added enough sulphuric acid to give it a tartish taste. This acidulated water was then mixed with the mass of oil and ore. A thick scum of sulphurets rose to the surface and was skimmed off, leaving the hitherto black ore as white as snow—in fact, pure silica. The gentlemen expressed themselves as pleased and the citizens of Baker County are in hopes they are, because it means the erection of a large plant at this point." (Transcript, page 415.)

Although the Fryer Hill publication makes no reference by name to the Everson patent or process, the operations described were undoubtedly the result of Miss Everson's invention. The experts for Minerals Separation, Limited, Dr. Liebmann and Dr. Chandler, commented upon these publications (Transcript, pages 256, 334 and 366), and testified that both publications referred to the Everson process.

The following details regarding the operations described in the Fryer Hill publication are of interest: The ore is crushed, mixed with oil, placed in a circular tank provided with a "rotating hollow tube," to which are attached two fans, the mixture is acidulated, steam is injected into it, and the action of the revolving tube,

the fans and injected acidulated steam causes the lighter portions of the mineral-charged oil to float, and the floating mineral-charged oil is then lifted upon perforated "doors," through the perforations of which the superfluous water is allowed to drain.

The agitator referred to in the Fryer Hill publication, acidulation, use of steam and oil are all features described and recommended in the patent in suit, and are all that is necessary to produce the desired result.

The statement in the Criley and Everson publication that "a thick scum of sulphurets rose to the surface and was skimmed off, leaving the hitherto black ore as white as snow" is precisely the same as the result described in the patent in suit, wherein it is stated (Transcript, page 475, near bottom of page) that "after vigorous agitation there is a tendency for a part of the oil-coated metalliferous matter to rise to the surface of the pulp in the form of a froth or scum."

The patent in suit adds nothing to the Everson process; it contains nothing more specific as to any detail of the process; whether one starts with the Everson disclosure as a basis of operations or with the patent in suit, the different elements of the process must be varied until the proper adjustment of all the conditions to fit the particular ore being treated are found. As above stated (*supra,* page 62) each ore today presents a separate problem and flotation is yet an experimental art. The patent in suit may state conditions suitable to the Broken Hill, Australia, ore therein mentioned. Everson stated conditions suitable for the ore she operated on. This is all anyone can do today. Suitable conditions must be found for each ore as it is encountered if possible, and if impossible to find such conditions, the ore cannot be concentrated by flotation.

Froment Process.

Froment British Patent No. 12,778 of 1902.

The next process in chronological order is that of Alcide Froment, set forth in his British patent (Transcript, page 706). Froment in his patent, referring to the use of a mixture of oil, ore and water, makes the following statement:

> "If a gas of any kind is liberated in this mass, the bubbles of the gas become covered with an envelope of sulphides and thus rise readily to the surface of the liquid where they form a kind of metallic magma." (Transcript, page 708.)

Froment then gives the following description of an example of his process:

> "Thus, for example, if in a test tube there is placed say ten grammes of sulphuretted copper ore with its gangue, a gram of limestone, the whole reduced to powder, and if there is added thereto thirty grammes of water, a few drops of sulphuric acid and a thin layer of ordinary oil, and the mixture then agitated for a brief space, the whole of the copperpyrite will instantly rise to the top of the liquid. The metallic spherules, pressed one against the other, will become grouped in a magma clearly separated from the rest of the liquid. If the limestone is in excess, or readily attackable, the rapidity of the separation is so great that the copperpyrite is forcibly projected outside the vessel. There is therefore a proportion to be sought for a given ore and limestone." (Transcript, page 708.)

It will be noted from the first of the foregoing quotations that Froment stated that if gas *of any kind* were liberated in the mixture of oil, ore and water the bubbles would become covered with an envelope of sulphides. This statement plainly shows that Froment was aware of the fact, and informed the public of the fact that oiled sulphides could be floated by any gas. In the specific

example set forth in the second quotation, Froment directs the use of limestone or calcite, which is calcium carbonate, and sulphuric acid for the purpose of generating carbon dioxide gas, and he also directed agitation of the mixture of oil, ore and water, which agitation would inevitably have the effect of introducing air into the mixture.

As shown by complainants' testimony, all of the ores to which complainants' alleged new process has been applied contain carbonates, as does also the ore treated by defendant in the operations upon which the charge of infringement rests.

In complainants' operations sulphuric acid is used, and generates carbonic acid gas by its action upon the carbonates contained in the ores treated. The carbonic acid gas so generated performs precisely the same function as in the Froment process.

In complainants' operations the mixture of oil, ore and water is agitated as directed in the Froment British patent, and this agitation has the same effect in complainants' and the Froment operations, namely, the introduction of air which contributes to the formation of the froth.

Froment, in his British patent, introduces a caution regarding the addition of limestone to the ore being treated. While in one of the examples cited by him he directs the addition of one gram, amounting to 10 per cent. of limestone, he concludes his description of this example by stating that there is a possibility of the mineral being forcibly projected from the vessel by an excessive evolution of carbon dioxide gas, and he states that there is therefore a proportion to be sought for a given ore and limestone; that is, it was Froment's idea that if so much carbon dioxide gas was generated as to project the mineral from the vessel by excessive effer-

vescence a lesser amount of limestone should be used in order to prevent such action.

In Froment's process, as in the alleged process of the patent in suit, the gas forming the bubbles consists of both air and carbon dioxide. The patentees state in the patent in suit (Transcript, page 476, next to last paragraph) that the froth or scum obtained by them "derived its power of flotation mainly from the inclusion of air bubbles introduced into the mass by the agitation." The use of the word "mainly" shows that they realized the presence of gases other than air.

As showing that there is no distinction between the Froment process and that of the patent in suit as regards the kind of gas—whether air or carbonic acid gas—in the bubbles forming the froth, we refer to the testimony of complainants' witnesses regarding the practice of the alleged process of the patent in suit, as follows:

Complainants' Bottle Test Same as Froment Process.

Edward H. Nutter, chief engineer of Minerals Separation American Syndicate, Limited, one of the complainant corporations, testified that when he desired to determine whether the process of the patent in suit would be applicable to an ore which he was called upon to test, he would take the finely ground ore, mix it with water and reagents in a bottle, and shake the bottle vigorously. He stated that he would vary the conditions in different tests, the variations consisting in agitation with different oily reagents, agitating the pulp before adding sulphuric acid, using water of different temperatures, and almost any combination or variation of these conditions. Mr. Nutter further states that in making such a test if a carbonate were present "in quantity

sufficient to produce some carbon dioxide, it would be reasonable to believe that the carbon dioxide had contributed in some measure to the formation of the froth, assuming that a froth was formed."

Following we quote Mr. Nutter's testimony referred to above:

> "If it were necessary for me to test an ore for the purpose of determining whether complainants' process was applicable to it, and I found it necessary to make this test without apparatus, I would take the finely ground ore, mix it with water and reagents in a bottle, and shake the bottle vigorously. If the ore was amenable to flotation concentration, some indications of the formation of a froth would be made. If I had a testing machine, of which there are more than one type, I would perform the operation in the machine and would vary the conditions in different tests on an ore to see which set of conditions gave the best results. The variations I would try would consist of agitation with or without sulphuric acid, with different oily reagents, with agitating the pulp before acid should be added, with agitating the water, sulphuric acid and oily (80-7) reagent before adding the ore, with agitating the pulp to some extent with the acidified water before adding the oil, with using water of different temperatures, and, in fact, almost any combination or variation of these conditions that the indications given as I went along seemed to warrant." (Transcript, page 43.)
>
> "In the bottle test which I have previously described with an ore wherein the carbonate was present in insufficient quantity to react with all the acid chemically, but was still there in quantity sufficient to produce some carbon dioxide, it would be reasonable to believe that the carbon dioxide had contributed in some measure to the formation of the froth, assuming that a froth had been formed . . ." (Transcript, page 48.)

The bottle test of Minerals Separation described by Nutter in the foregoing quotations from his testimony

is in nowise different from the example of the Froment process described in his patent and quoted on page 118, *supra.*

Testimony Regarding Carbonates in Ores Treated by Minerals Separation, Limited.

Mr. Ballot, managing director of Minerals Separation, Limited, testified (Transcript, page 165, paragraph beginning at line 8) that all of the Australian ores treated by complainants' process contain calcite or limestone "some very little and others a great deal more." A. W. Wincey, superintendent of a mill in Australia, where complainants' alleged process is employed, and one of the witnesses for Minerals Separation, Limited, stated (Transcript, page 247, last two paragraphs) that the ore treated in Australia by said process contains about 1 per cent. (which is the amount recommended in the Froment Description referred to later) of calcite, and running up as high as 3 per cent. of calcite.

Carbonic acid in the free state is a gas. In limestone (the chemical name of which is calcium carbonate and the mineralogical name calcite) carbonic acid is combined with lime, the combination of the two being the solid substance, limestone. The action of a strong acid, such as sulphuric acid, on limestone is explained by Dr. Liebmann as follows:

> "Perhaps it would be useful to explain the function of this sulphuric acid. Calcium carbonate is a combination of calcium oxide and carbonic acid. In order to release the carbonic acid from the calcium carbonate, which chemists call the calcium salt of carbonic acid, it is necessary to act on it with a stronger acid which expels the carbonic acid and takes its place. Chemistry teaches us that this action is produced by using definite quantities of both

calcite and sulphuric acid and that to get all the carbonic acid from one gram of calcite, one gram of concentrated sulphuric acid is to be used." (Transcript, page 286.)

From the foregoing it will be apparent that if an ore contains 1 per cent. of calcite an amount of sulphuric acid equal by weight to 1 per cent. of the weight of the ore will be sufficient to decompose all of the calcite and thus release all of the carbonic acid gas.

Acid Used by Minerals Separation, Limited.

Nutter, chief engineer for Minerals Separation, Limited, and a witness for his employer, testified that in the practice of the Minerals Separation process in Australia the amount of sulphuric acid used was from 15 to 25 pounds per long ton of ore. (Transcript, page 49, paragraph beginning at line 6.) Chapman, a metallurgist in the employ of Minerals Separation, Limited, who was one of their witnesses, gave the amount of sulphuric acid used in Australia as from 15 to 20 pounds per long ton. (Transcript, page 194, lines 7 and 8, from bottom of page.) Wincey, superintendent of a mill in Australia, who testified as a witness for Minerals Separation, Limited, stated that the amount of sulphuric acid used was "somewhere in the neighborhood of 19 lbs." per ton. (Transcript, page 247, just above the middle of the page.)

The amounts of acid stated by the witnesses above referred to range from 15 to 25 pounds per long ton, 2240 pounds, *i. e.*, from a little less to somewhat over 1 per cent. of the weight of the ore, which amount of acid would decompose and free the carbonic acid gas from the same amount of calcite or limestone.

In the example of his process described in his British patent Froment described an operation in which he used

10 grams of ore, 1 gram of limestone, and a few drops of sulphuric acid (Transcript, page 708). While the amount of limestone (1 gram) mentioned by Froment is 10% of the weight of ore (10 grams) it is obvious that the "few drops of sulphuric acid" would release the carbonic acid gas from but a small part of the gram of limestone—this for the reason stated by Dr. Liebmann that 1 gram of sulphuric acid must be used to get all of the carbonic acid from 1 gram of calcite or limestone, and as also stated by Dr. Liebmann, a few drops of sulphuric acid must be less than a gram. (Transcript, bottom of page 286 and top of page 287.) Therefore, in the process described in the Froment British patent the amount of carbonic acid gas entering into the formation of the floating mineral enveloped bubbles was quite small, being only that liberated from an amount of limestone weighing much less than 10% of the weight of the ore.

In their Australian operations above described the Minerals Separation process involved the treatment of ores containing from 1% to 3% of calcite or limestone, and the use of from a little less to somewhat more than 1 per cent. of sulphuric acid, and hence the generation of carbonic acid gas from an amount of limestone equal to about 1 per cent. of the weight of the ore. From Dr. Liebmann's testimony it appears that there is no difference in the effect of limestone naturally occurring in an ore and limestone added to an ore. (Transcript, page 285, top of page.)

The description of the Froment process contained in Froment's British patent, taken in connection with the testimony of the witnesses produced by Minerals Separation, Limited, demonstrates that in both processes carbonic acid gas is generated, and that in both processes the mixture of ore, water, oil and acid is agitated, and

necessarily the agitation would introduce air into the mixture as much in one case as in the other. The only possible ground upon which any contention can be made by Minerals Separation, Limited, that there is any difference between the two processes in respect to the formation of the floating mineral-coated bubbles is upon the theory that there is a difference in the relative amount of carbonic acid gas and air in the Froment bubbles and the Minerals Separation bubbles. And Minerals Separation, Limited, does in fact contend that the Froment bubbles are filled principally with carbonic acid gas, and that the Minerals Separation bubbles are filled principally with air, *i. e.*, as stated in the patent in suit:

> ". . . a froth or scum which has derived its power of flotation mainly from the inclusion of air bubbles introduced into the mass by the agitation . . . " (Transcript, page 476, next to last paragraph.)

Now, in the example of the Froment process described in the Froment British patent Froment used, as above stated, 1 gram, *i. e.*, 10% of calcite or limestone, and only a few drops of sulphuric acid, which, as stated by Dr. Liebmann, is less than 1 gram, *i. e.*, less than 10%. Hence the amount of carbon dioxide gas generated in the Froment process is the amount generated by less than 10% of sulphuric acid, and necessarily by much less than 10%, for the reason that "a few drops," say, three or four drops, would be much less than a gram. As above stated, the Australian ore treated by Minerals Separation, Limited, contained from 1 per cent. to 3 per cent. of calcite or limestone, and the amount of sulphuric acid ranged from a little less to somewhat more than 1 per cent. Upon this showing alone there is no foundation for any valid argument that the Minerals Separation process is novel and patentable. Even granting,

for the sake of argument, the existence of a little more carbonic acid gas in the Froment bubbles than in the Minerals Separation bubbles, the useful result is precisely the same. Chapman, a metallurgist in the employ of Minerals Separation, Limited, when asked whether it made any difference from a practical standpoint how much carbonic acid gas and how much air there was in the froth, replied: "We naturally had to take the froth as it was produced." (Transcript, page 204, X-Q. 219.)

But there is not the slightest ground for assuming that in the Froment bubbles the proportion of carbonic acid gas to air was any greater than in the Minerals Separation process.

We shall next refer to the application by Minerals Separation, Limited, of the process in which they claim ownership to the ore of the San Francisco del Oro mine containing a very large amount of limestone or calcite and involving the use of a very large amount of sulphuric acid, and resulting in the generation of more than enough carbonic acid to float six or seven times the entire weight of the ore treated, to say nothing of how much the excess was over the amount necessary to float the comparatively small amount of metalliferous matter in the ore; and we shall refer to certain instructions furnished to Minerals Separation, Limited, by Froment at the time he sold his British and Italian patents to that company, a date prior to the date of the alleged invention of the process of the patent in suit, in which instructions Froment specifically directs the use of only 1 per cent. of limestone or calcite (Transcript, page 412), an amount equal to that acted upon by the acid in the Australian operations by Minerals Separation, Limited, and much less than that contained in and acted upon by acid in the treatment of the San Francisco del Oro or by Minerals Separation, Limited.

Process of the Patent in Suit Applied to San Francisco Del Oro Ore.

Mr. Ballot testified (Transcript, page 158, last paragraph) that Minerals Separation, Limited, had treated the ore of the San Francisco del Oro mine of Mexico by the alleged new process of the patent in suit. Dr. Liebmann, one of complainants' expert witnesses, testified (Transcript, page 312, just above middle of page) that the San Francisco del Oro ore contains from 4 per cent. to 5 per cent. of limestone.

Mr. George A. Chapman, one of complainants' engineers and metallurgists, testified (Transcript, pages 194-195, beginning at bottom of page 194; and page 200, top of page) that in treating the San Francisco del Oro ore Minerals Separation used from 60 to 70 pounds of commercial sulphuric acid, equivalent to from 43 pounds to 56 pounds of pure sulphuric acid per ton of ore, and that the acid was immediately consumed by reaction with the limestone present in the ore. Mr. Chapman testified that the 43 pounds of pure sulphuric acid and the 56 pounds of pure sulphuric acid used would yield, respectively, 19 pounds and 25 pounds of carbonic acid gas. The prevailing temperature at the Wales plant, which was located at the town of Emu, Mr. Chapman testified was from 65° to 70° Centigrade, at which temperature, as stated by Mr. Chapman, the 19 pounds to 25 pounds of carbonic acid gas would have a volume of 209 to 275 cubic feet, which volume of carbonic acid gas was generated for each ton of ore treated. (Transcript, page 200.) As stated by Mr. Chapman (Transcript, page 201, near bottom of page), the buoyant effect, or lifting effect, of 1 cubic foot of carbonic acid gas in water is 62.4 pounds, and the buoyant effect, therefore,

of the 275 cubic feet of carbonic acid gas generated would amount to 275 multiplied by 62.4, which is 17,160 pounds. By a similar calculation the minimum volume of carbonic acid gas, 209 cubic feet, would have a lifting effect in water of 13,041 pounds.

In connection with the foregoing it is to be noted that this immense amount of carbon dioxide gas was generated for each and every ton of ore that passed through the plant at Emu, Wales, in treating the ore of the San Francisco del Oro mine. Taking the basis of calculation as the English long ton, 2240 pounds, we find that complainants in applying their process generated enough carbon dioxide to float six or seven times the entire weight of the ore treated, including not only the concentrate, but also its gangue. This is a vastly greater amount of carbon dioxide gas than was ever dreamt of by Froment. In the example described in his patent, while Froment added 10% of calcite to an ore which contained no calcite, he recommended caution as to the amount of calcite and only used a few drops of sulphuric acid, which would have decomposed a very small fraction of the limestone added and would have produced but a small amount of carbon dioxide gas.

When asked whether it made any difference from a practical standpoint how much carbon dioxide gas and how much air there was in the froth, Mr. Chapman stated that "we naturally had to take the froth as it was produced" (Transcript, page 204, X-Q. 219). This was a truthful answer and shows the identity of the Froment process and the process of the patent in suit. In each case the same operations are performed, and the operator has to take the froth as it is produced, it being immaterial what gas is in the bubbles so long as the concentrate floats.

The actual proportions of carbonic acid gas and air

in the froth formed in the treatment of the San Francisco del Oro ore was ascertained by Dr. Liebmann, and is stated under the caption "Carbonic Acid Gas in Froths Produced by Process of Patent in Suit" (*post*, page 157).

Froment Description and Purchase of Froment Process by Minerals Separation, Limited.

In August, 1903, Mr. John Ballot, managing director of Minerals Separation, Limited, and one of the grantees of the patent in suit, first learned of the Froment process (Transcript, page 165, about the middle of the page), and, as appears from his testimony (Transcript, page 170, last two paragraphs) and from the testimony of Mr. Ballantyne, patent solicitor for Minerals Separation, Limited (Transcript, page 223, beginning at line 15), Mr. Ballot asked Mr. Ballantyne to open negotiations for the purchase of Froment's patent rights, whereupon Ballantyne communicated with his agent at Rome and obtained an option from Mr. Froment.

Mr. Ballot states that he sent an agent to Italy to negotiate with Mr. Froment; that this agent failed to effect the purchase, whereupon Mr. Ballot personally went to Italy and perfected the purchase of the Froment patents for Minerals Separation, Limited, which purchase was completed on the 17th of November, 1903. The assignment (Transcript, page 468) runs to Ballot, but the purchase was made on behalf of Minerals Separation, Limited, and the Froment patents were reassigned to that company as stated by Mr. Ballot (Transcript, page 170, upper part of page). Mr. Ballot states that he arranged with Mr. Froment to send all possible information, together with plans, drawings, and a model plant to England for the use of Minerals Separation,

Limited (Transcript, page 170, last two paragraphs). These instructions were received by Minerals Separation, Limited, in December, 1903 (Transcript, page 167, just below the middle of the page), and are in evidence as Complainants' Exhibits "Froment Description" Transcript, page 406), a translation thereof (Transcript, page 409), "Froment Plan" (Transcript, page 556), and "Froment Drawing A" (Transcript, page 556).

Prior to the purchase of the Froment patents by Minerals Separation, Limited, that company had the process tested by Messrs. Sulman and Picard (Transcript, page 170, R-D. Q. 147), two of the joint grantees of the patent in suit. Mr. Picard describes the tests of the Froment process at this time as having resulted in obtaining fairly good recoveries of the sulphide minerals when operating according to the directions contained in the paragraph of Froment British patent, beginning with the words "Thus for example." (Transcript, page 149, Q. 13.)

The fact that Minerals Separation tried the Froment process and obtained fairly good results, as stated by Picard, and the fact that two journeys were made to Italy for the purpose of purchasing the Froment patents, clearly shows that Minerals Separation, Limited, regarded the Froment process as a successful one.

Froment Process Patented Only in England and Italy.

It appears, however, from the testimony of Mr. Ballantyne (Transcript, page 241, just above X-Q. 127) that he was informed by Mr. Froment that the Froment process was not patented in any countries other than England and Italy, and that he, Ballantyne, verified this information by making a search. It is a fact of general

knowledge that patents upon a process of this kind in these two countries alone would be of insignificant value, if of any value at all, as compared with patents covering the great metal-producing countries of the world. The fact that the Froment process was not patented in any country where such a process is valuable is a complete explanation of the failure of Minerals Separation, Limited, to introduce that process into use. As appears from the bill of complaint and evidence, Minerals Separation, Limited, is not an owner of mines interested in securing the greatest output of values therefrom, but, as stated in the bill of complaint, their business consists in installing apparatus and granting licenses under their patents, conditioned on the payment of royalties measured by the output of the process of ore concentration used (Transcript, page 4, just below middle of page). Obviously, complainants could not derive any royalties from the Froment process for the simple reason that it was patented only in England and Italy—two countries of practically no importance whatever so far as the use of such a process is concerned.

In November, 1903, when Mr. Ballot purchased the Froment patents on behalf of Minerals Separation, Limited, it was too late to have application for patents made in the United States and other countries by reason of the provisions of the International Convention which governs the granting of patents by most of the large nations in cases where patents have previously been granted in other countries. The provisions of the convention upon this point are embodied in Section 4887 of the Revised Statutes of the United States and bar the grant of a patent when a foreign patent has previously been granted upon an application filed more than twelve months prior to the United States application. The Froment British patent was applied for June 4, 1902

(Froment patent, Transcript, page 706), and sealed August 18, 1903 (Stipulation Transcript, page 283), and thus in November, 1903 (date of purchase of Froment patents by Minerals Separation, Limited, as shown by assignment, Transcript, page 468, and by Mr. Ballot's testimony, upper part of page 170 of Transcript), constituted a bar to applications for patents in other countries which are parties to the International Convention, such countries including the United States.

Following is Section 4887 of the Revised Statutes, also Section 4886, which is referred to in Section 4887:

> "Sec. 4887. No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months, in cases within the provisions of section forty-eight hundred and eighty-six of the Revised Statutes, and four months in cases of designs, prior to the filing of the application in this country, in which case no patent shall be granted in this country. . . ."
>
> "Sec. 4886. Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."

Evidence of Intent to Suppress Froment Process.

The suppression of the Froment process is shown by the fact that while the preliminary tests of the process made by Messrs. Sulman and Picard on behalf of Minerals Separation, Limited, were of such character as to bring about the purchase of the Froment patents, no adequate tests were ever made of the model apparatus sent to Minerals Separation, Limited, by Froment after the sale of the patents; and the "Froment Description" and "Froment Plan" were never shown to A. H. Higgins (Transcript, page 251, folio 507), or to G. A. Chapman (Transcript, page 199, folio 400), the metallurgists who tested the Froment apparatus; and Chapman is not sure that he had even seen the Froment patent at the time of his experiments (Transcript, page 199). The evidence does not show that any one other than a translator ever saw the "Froment Description" and "Froment Plan" except the grantees of the patent in suit, Messrs. Sulman, Picard and Ballot until these papers were brought from hiding at the time of this suit.

The indifferent character of the experiments performed by Higgins with the Froment apparatus is shown by his statement (Transcript, page 176, folio 354) that he performed one or two experiments and put the apparatus aside, as the results were hopeless. He says that the Froment apparatus was undoubtedly "scrapped," *i. e.*, broken up for junk (Transcript, page 176, folio 354). Of course his experiments were failures. How could they have been otherwise when he was not permitted to see the "Froment Description," which contains full instructions. No one, however skilled, can be expected to take an apparatus and carry out a process with it unless given proper instructions. If Minerals Separation, Limited, had wanted the Froment process to operate, they would

have given their metallurgists all of the information in their possession, and especially the instructions received from the inventor, Froment. Chapman (Transcript, page 182, folio 365) says very few tests were necessary to show that the Froment apparatus was unworkable. Quite naturally he found it unworkable, as he did not have the necessary instructions, but, on the contrary, was wrongly instructed as appears below. The Froment apparatus is nothing but an agitator and settling-box with connections for supplying steam, oil, etc., and could have been used in many different ways, as such apparatus had been used for many purposes before the date of the Froment invention. Froment's invention was a process, not a machine. Chapman was given the machine, but the description of the process was withheld from him.

Chapman says (Transcript, page 199, bottom of page) that he always used 10 per cent. of calcite in testing the Froment process. The Froment patent (Transcript, page 708, paragraph beginning with the words "Thus for example") says that a proportion was to be sought as to the amount of calcite, and the "Froment Description" recommends one per cent. of calcite and 2 per cent. in extreme cases (Transcript, page 411, folio 829). But this information was withheld from Chapman by his employer, Minerals Separation, Limited. Chapman says that under Mr. Sulman's instructions (Transcript, page 199, folio 401) he used from 3 per cent. to 6 per cent. of oil in trying the Froment process. If Mr. Chapman had been allowed to read the "Froment Description" he would have learned that ordinarily 1 per cent. or 2 per cent. of oil is sufficient, and that amounts as high as 3 per cent. or 3½ per cent. are required only in extraordinary cases (Transcript, page 411, near bottom of page). Chapman said (Transcript, page 199, folio 401) that he

had no idea of the speed of the beaters in his trial of the Froment process. If he had seen the Froment description he would have known that the beaters of the large apparatus to which the description refers should have been revolved at about 300 revolutions per minute (Transcript, page 410, top of page), from which he could have ascertained the proper speed for the beaters of the model apparatus.

Experiments were also performed by the witnesses in this suit for Minerals Separation, Limited, in an alleged reproduction of the apparatus sent them by Froment. The original apparatus sent by Froment was destroyed years ago (Transcript, page 168, near bottom of page; page 176, just above Q. 53). Mr. Ballot (Transcript, page 168, near bottom of page) stated that the original apparatus was fitted with two beaters made of stout wire somewhat like gridirons, so that while revolving in opposite directions the wires passed between one another, and Mr. George A. Chapman (Transcript, page 198, third paragraph), gave a similar description of the apparatus furnished by Froment. The reproduced apparatus in evidence does not conform to this description, and contains nothing in the slightest degree resembling "two beaters made of stout wire somewhat like gridirons." Chapman was recalled for the purpose of having him correct his testimony to conform to the reproduced Froment apparatus in evidence, but the best he could say was that the beaters of the reproduced apparatus are almost exactly the same as in the old apparatus (Transcript, page 387, bottom of page). Mr. Higgins, another of complainants' witnesses (Transcript, page 251) gave a description of the original Froment apparatus more nearly conforming to the exhibit in evidence. The testimony, however, is so confused as to leave the reproduced exhibit apparatus in evidence without any convincing

evidence as to whether or not it bears any resemblance to the original Froment apparatus, which has been destroyed.

These defective experiments performed by employees who were purposely kept in ignorance of the information contained in the Froment patent and the Froment instructions, show a wilful neglect of the Froment process. Inasmuch as the Froment process was patented only in England and Italy, Minerals Separation, Limited, could derive no revenue therefrom, and it was therefore to their interest to suppress it in order to leave the field clear for the exploitation of the same process under the artful and deceptive guise thrown around it by the patent here in suit.

The Froment description, Froment drawing A and Froment plan given to Minerals Separation, Limited, by Froment contained a full description of his apparatus and of a form of his process differing slightly in the order of operations from that set forth in his British patent. The operations described in the Froment patent and in the Froment description, however, differ only in minor details and were understood by Minerals Separation, Limited, as they would be by any one, to be descriptions of the same process. This is shown by the fact that the Froment description was sent to Minerals Separation, Limited, in response to Mr. Ballot's request for working details of the patented process, and is further demonstrated by the testimony of Messrs. Sulman and Picard, two of the joint grantees of the patent in suit. Messrs. Sulman and Picard testified (Transcript, pages 128 and 148) to certain tests of the Froment process in which they varied slightly from the procedure set forth in the Froment British patent. Later, Mr. Picard produced the Froment description, drawing and plan (Transcript, page 156), and referred to them as showing the reason

why in some of his experiments he deviated from the precise order of procedure set forth in the Froment British patent.

Amount of Oil in Froment Process and Process of Patent in Suit.

The Froment description contains the following passage relative to the amount of oil recommended for use by him in his process:

> "(*Remark.*) If the ore contains more than five per cent. of metallic matter, such as copper, lead, it will be necessary to add a little more oil. As a general rule, one may assume:
>
> 1 % of oil for ore containing up to 5% of metals
> 1½% " " " " 10% "
> 2 % " " " " 15% "
>
> "It is very rare that one has to enrich ore containing more than 15% copper. In our countries, Italy, France, Spain, ore containing 15% of metallic copper is considered very rich and is treated as such. In case of lead ore, concentration is continued until the ore contains 60% of lead; this latter proportion is seldom exceeded.
>
> "Consequently for a lead ore containing 20% of metallic matter, it will be necessary to use 2% of oil.
>
> "2. For ore containing 30% of metallic lead 2½% of oil.
>
> "3. For ore containing 40% of metallic lead 3% of oil.
>
> "4. For ore containing 50% of metallic lead 3½% of oil, etc." (Transcript, pages 411, 412.)

Complainants have attempted to distinguish their alleged process from that of Froment by introducing testimony to the effect that it requires vastly more than 1 per cent. of oil to form the thin layer of oil upon water in a test tube, as described by Froment in his British patent. Froment in his patent directs the use in the test tube "of a thin layer of ordinary oil" (Transcript, page

708, paragraph beginning "Thus for example"). Every one is aware of the facility with which a minute quantity of oil spreads out upon the surface of water and forms an infinitesimally thin layer or film. Dr. Eugene A. Byrnes, defendant's expert witness, in explaining the Froment patent and in performing the experiments regarding which he testified, interpreted the expression "a thin layer" as equivalent to a small quantity or a few drops. In his Froment experiments Dr. Byrnes used amounts of oil varying from a fraction of 1 per cent. by weight relative to the ore to about 3.6 per cent. by weight relative to the ore used. Some of these experiments were performed in test tubes and some in larger apparatus. These experiments are described upon pages 103 to 105 and pages 107 to 108 of the Transcript.

Minerals Separation, Limited, through the testimony in rebuttal of their witnesses, Mr. William H. Ballantyne and Dr. Adolf Liebmann, have raised the contention that a much larger amount of oil than that referred to and used by Dr. Byrnes is necessary to form a layer upon the surface of water in a test tube. Mr. Ballantyne (Transcript, page 236, next to last paragraph) stated that he had frequently tried the Froment process in a test tube and found that the thin layer of oil amounts to not less than 5 per cent. on the weight of the ore, the weight of ore being stated as ten grammes in the test tube demonstration described in the Froment patent. Dr. Liebmann (Transcript, pages 287, top of page; 295, near top of page; 332, lower part of page; 356, folio 724) fixes the amount of oil necessary to form a layer in the test tube example referred to by Froment in his patent as about 12½ per cent., by weight of the ore, and with some oils as high as 14 4/10 per cent.

Upon cross-examination Dr. Liebmann admitted that a thin layer on water in a test tube would be formed by

0.15 cc. (1.3 per cent.) of turpentine; 0.175 cc. (1.5 per cent.) of a mixture of 90 per cent. turpentine with 10 per cent. of olive oil; 0.225 (2 per cent.) of a mixture of 75 per cent. turpentine, with 25 per cent. of olive oil; 0.2 (2 per cent.) of wood tar oil; 0.25 cc. (2.27 per cent.) of pine oil and 0.15 cc. (1.4 per cent.) of sweet pine oil or pinoline. The percentages above given in parentheses are calculated, as hereinbefore explained (*supra,* page 41) from the specific gravities of the substances as given by Dr. Chandler, and relate to the ten grams of ore used by Froment in the test tube demonstration described in his patent (Transcript, pages 354, 385).

As above stated (*supra,* page 137), Froment in his description sent to Minerals Separation, Limited, recommended from 1 per cent. to 3 per cent. of oil, and for a particular ore (lead ore containing from 30 per cent. to 50 per cent. metallic lead) he recommended from 2½ per cent. to 3½ per cent. oil.

It is significant that at the time defendant's expert witness, Dr. Byrnes, testified and interpreted the Froment British patent as specifying an amount of oil ranging from less than 1 per cent. to about 3.6 per cent., he had no knowledge of the Froment description. That document was preserved in secrecy by Minerals Separation, Limited, until a later date, but when produced it precisely corroborated Dr. Byrnes' interpretation of the Froment patent.

Agitation in Froment Process and in Process of Patent in Suit.

Froment in his British patent (Transcript, page 708) gives an example of his process and directs that the mixture be "agitated for a brief space"; and in the Froment description he says that "the mixing apparatus is left to work for about ten minutes" (Transcript, page 411, folio 829).

In the example of his process described in the Froment British patent the agitation consists in shaking the mixture in a test tube, which is simply a long, narrow bottle of thin glass, and on account of its narrowness having no neck. This kind of agitation is precisely the same as that described by Nutter, chief engineer for petitioner, Minerals Separation, American Syndicate, who testified (Transcript, page 43) that in testing an ore for the process of the patent in suit he would place the ore, water and reagents in a bottle and shake the bottle vigorously (*supra,* pages 120 and 121).

Agitation of the character referred to by Froment would thoroughly aerate the ore pulp, *i. e.*, would introduce into the pulp innumerable minute air bubbles which would rise to the surface as a froth when the mixture was brought to rest. A simple trial demonstrates this. Furthermore, the fact is admitted by Mr. Nutter in his description of the bottle test above referred to. Mr. Ballantyne, a witness for his client, Minerals Separation, Limited, also testified (Transcript, page 238, X-Q. 87) that with quantities of oil as low as 1 per cent. by weight relative to the ore he could not suggest any kind of agitation that would cause efficient contact of the oil with the metalliferous particles of the mineral that would not also cause air to be entrained in the pulp. Mr. Ballantyne added that the only way the entraining of air could

be prevented would be by performing the operation in a vacuum or completely filling a closed vessel with the pulp. Even complainants did not contend that Froment resorted to either of these absurd measures.

Froment in his description recommended oil in amounts as low as 1 per cent., and directed that the agitation be continued for about ten minutes, and stated that all the sulphide "grains should come into thorough contact with the oil" (Transcript, page 411, folio 829). The patent in suit directs agitation for "two and one-half to ten minutes, until the oleic acid has been brought into efficient contact with all the mineral particles in the pulp" (Transcript, page 476, just below middle of page).

In the Froment description Froment defines the degree of agitation by reference to the speed of rotation of the mechanical mixing device. He describes the agitating mechanism, or "centrifugal mixing device," as he terms it, as "composed of a cylindrical body, made of strong sheet-iron riveted with bolts in which two stirring devices work in opposite directions, making about 300 revolutions per minute" (Transcript, page 410, top of page). Froment describes the vat B shown in the Froment plan (Transcript, between pages 556, 557) as having a diameter of 1.7 metres (Transcript, page 410, lines 19, 20), and upon this scale the mixing device A, shown in the upper left-hand corner of Complainants' Exhibit Froment Plan, would have a diameter of about 1 metre, or 3 feet. A. W. Wincey, one of the witnesses for Minerals Separation, Limited, testified (Transcript, page 248, near top of page) that in the application of the Minerals Separation process in Australia the agitating boxes are 3 feet square and the agitators, or mixers, are revolved at a speed of from 265 to 270 revolutions per minute. It will be apparent that complainants have followed in Froment's footsteps almost precisely, both as to the size of the agi-

tating vessels and the speed of rotation of the agitators. It is quite apparent that Froment's apparatus would be as effective an instrument for introducing air as would that used by Minerals Separation, Limited, the two machines being practically identical. When interrogated upon this point Mr. Ballantyne, a metallurgist and solicitor and one of complainants' expert witnesses, testified as follows:

> "Or, if Froment's centrifugal mixing device was used as described in the 'Froment Description,' and if air were beaten into the centrifugal mixing device, as in my opinion it would be, this would not be inconsistent with Froment's process, but would and does constitute the first step of the Froment process." (Transcript, page 241, folio 488.)

This is a conclusive admission that in the matter of beating air into the pulp there is no difference between Froment's operation and that of Minerals Separation, Limited.

Dr. Byrnes' Froment Experiments.

Dr. Byrnes, expert witness for defendant, performed test tube experiments illustrative of the Froment process. In some of these experiments Dr. Byrnes eliminated some of the causes contributing to flotation in order to better demonstrate the effect of other causes. Seven of Dr. Byrnes' experiments were test tube operations as described in the Froment British patent, and, for convenience, we quote his description of these experiments:

> "(1) A glass test tube holding 100 cubic centimeters was held [half] filled with water, corked and well agitated for a brief period. The air in the tube above the water was thus shaken into it and intimately distributed throughout it in the form of fine bubbles, which, however, quickly rose to the surface of the water and escaped as soon as the agitation was discontinued.

"(2) The same experiment was repeated, with the difference that one drop of 'red oil,' the impure oleic acid used by defendant in carrying out his process, was first added to the water. In this case, the fine bubbles of air entangled in the water upon agitation did not quickly float, but remained distributed throughout the water for a considerable period, giving it a milky appearance.

"(3) Ten grains of the ore which is being treated by defendant according to his process involved in this suit, finely-powdered, was taken and placed in the empty 100 cc. test tube. This ore, from the 'Black Rock' mine of the Butte & Superior Copper Company, assayed about 20 per cent. zinc, equivalent to a content of about 30 per cent. of zinc sulfid. It also contained rhodochrosite, a manganese carbonite easily decomposed by sulphuric acid to give carbon dioxide gas. Upon adding thirty cubic centimeters of water to the ore in the test tube, some of the mineral floated by reason of the air within the mass of ore and the films of air surrounding some of the small particles.

"(4) A few drops of sulphuric acid were now added to the ore and water in the test tube, and the mixture was gently heated, whereupon gas was chemically liberated by the action of the acid on the carbonate and sulfid of the ore, evolving carbon dioxid and hydrogen sulfid, and considerable mineral rose to the surface of the liquid, floated by the adherent gas-bubbles, as in the well-known Potter and Delprat methods, heretofore referred to by me. This mineral, however, floated for a brief period only and then again subsided to the bottom of the tube.

"(5) One drop of olive oil was now added to the acidulated water and ore in the test tube, and the tube was agitated for a brief space, whereupon a large mass of oiled and aerated mineral floated to the top, in the form of a magma or froth having the characteristics described in the Froment patent. It was found that agitation of the mixture for a brief period, such as was necessary to distribute the drop of oil over the innumerable particles of zinc sulfid in the ten grams of ore and moisten their surface with a film of oil, also thoroughly aerated the liquid by the air shaken into it, just as in the experiment

numbered (2) above. These fine bubbles of air throughout the mass, as well as the nascent gas chemically liberated throughout the mass, attached themselves to the oiled particles and assisted in floating them to the top as a froth.

"(6) In order to oil the mineral particles without agitation, two drops of cotton-seed oil were dissolved in a few cubic centimeters of ether, and ten grams of the finely-powdered 'Black Rock' ore heretofore described was moistened with the solution. The ether was allowed to evaporate, leaving the oil adhering to the mineral particles as a thin film. The oiled ore was then placed in a test tube, thirty grams of water were introduced, five drops of sulphuric acid were added, and the whole was gently heated to cause the sulphuric acid to react on the carbonate in the ore. The nascent gas generated by the reaction attached itself to the oiled mineral particles and floated them to the top.

"(7) Ten grams of the 'Black Rock' ore were mixed in one instance with one gram of limestone, or calcium carbonate, as prescribed by Froment, and in another instance with a half gram of rhodochrosite, the manganese carbonate occurring in the 'Black Rock' ore, a thin layer or a few drops of olive oil were added, and a few drops of sulphuric acid. On warming to start the reaction, and agitating for a brief period, the oiled mineral floated as a froth." (Transcript, pages 103-105.)

Dr. Byrnes' seven test tube experiments show the following facts:

(*a*) Experiments 1 and 2 show that an ore pulp cannot be agitated sufficiently to distribute the oil, as directed by Froment, without impregnating the water with air in the form of minute bubbles.

(*b*) Experiment 1 shows that bubbles of air in water are short lived, quickly rising to the surface and escaping.

(*c*) Experiment 2 shows that the addition of oil to water gives permanency to the air bubbles, thus indicating the function of oils and other similar substances in the flota-

tion process. This fact was commented on above (*supra*, pages 95 and 96).

(*d*) Experiment 3 shows the inherent tendency of ore particles to float by reason merely of the small amount of air inclosed between the dry ore particles.

(*e*) Experiment 4 shows the tendency of gases generated in the pulp, such as carbon dioxide and hydrogen sulfid, to float the particles without the assistance of agitation or oil.

(*f*) Comparison of the results of experiments 4 and 5 shows that the Froment result is due principally to the introduction of air into the pulp by agitation.

(*g*) Experiment 6 shows that generated gas without agitation will cause flotation of part of the oiled ore, and, furthermore, shows that flotation by the action of carbonic acid gas or other gas generated in the mixture cannot be accomplished solely by the effect of such generated gas, except by means of the elaborate precautions taken by Dr. Byrnes, namely, introducing the oil in the form of an ether solution, in order to avoid agitation, which, if performed as directed by Froment, necessarily introduces an immense amount of air into the pulp, which air so introduced is the principal cause of flotation.

(*h*) Experiment 7 shows that froth produced by following Froment's directions is the same, whether calcium carbonate be added to the ore or whether the ore contain only the rhodochrosite which naturally occurs in defendant's ore.

Dr. Byrnes' Slide Machine Froment Experiments.

Dr. Byrnes also performed a series of experiments illustrative of the Froment process, using the small apparatus referred to in these proceedings as the "slide machine." We quote below Dr. Byrnes' description of these experiments, and in our quotation we have numbered the experiments for convenience, and will refer to them as Dr. Byrnes' slide machine experiments, with the numerals appearing at the beginning of each paragraph of the quotation:

(1) "A mixture of 492 grams of ore, 1700 cc. or grams of water, at 70° Fahrenheit, 0.3 cc. of cotton-seed oil and one cc. of sulphuric acid was agitated and defrothed five times. The five froths were filtered and dried, giving concentrates having a weight of 170.5 grams, reported by the assayer to contain 50.0 per cent. of zinc. The tailings weighed 315.5 grams and had a reported zinc content of 4.2.

(2) "The process was repeated under precisely the same conditions, except that 20 cc. of cotton-seed oil, or 66 times as much, was used. Six froths were made and removed, and dried concentrates, plus some oil therein, weighed 211 grams and had a zinc content of 48.3 per cent. The tailings, plus some oil therein, weighed 292 grams and contained 1.0 per cent. of zinc.

(3) "The process was repeated under precisely the same conditions, except that 20 cc. of Ehrmann's California olive oil was used. Five froths were made and removed; the concentrates, plus some oil, weighed 219 grams and having a zinc content of 44.3 per cent. The tailings, including some oil, weighed 274 grams and contained 0.6 per cent. of zinc.

(4) "The process was repeated under the same conditions, but using 20 cc. of 'red oil,' impure oleic acid, from Charles T. Perry & Co., of Helena, Montana. Three froths were made, removed and dried. The weight of the concentrates

was 65 grams and their reported zinc content was 42.2 per cent. The tailings were not cleaned, but showed on their surface small particles of aggregated mineral, or 'flocks,' perhaps half a millimeter, or one-fiftieth of an inch, average diameter.

"The amount of cotton-seed, olive and 'red oil' used in the last three operations was more than 3.6 per cent. of the weight of the ore, and more than 12 per cent. of the weight of the zinc sulphide in the ore.

(5) "The process was repeated under the same conditions, using 500 grams of ore, except that ten cc. of 'red oil' was used. Four froths were made, removed and dried. The concentrates therein weighed 202 grams, and had a reported zinc content of 47.5 per cent. The tailings were very white, weighed 288 grams, and contained a reported zinc content of 1.1 per cent. It should be noted that the 'red oil' used in this test was a special or somewhat purer form of oleic acid than that used in the preceding run, more of the solid fatty acids, stearic and palmitic, having been removed by the maker, Charles T. Perry & Co., rendering it thinner and less viscous, pasty or solid at ordinary temperatures." (Transcript, pages 107-108.)

Discussion of Dr. Byrnes' Froment Experiments.

Dr. Byrnes commented upon his Froment test tube demonstrations and his slide machine experiments as follows:

"Froment confines his description to the process and its principles, leaving the type of agitator to be determined by the user. In Froment's test-tube experiment, agitation sufficient to coat the mineral particles with a thin film of the oiling agent also thoroughly aerates the mixture, the fine bubbles of air distributed throughout it, and attaching themselves to the oiled particles, acting with the chemically-evolved gas to float them. The function of the gas-bubbles is identical, whether they be of atmospheric

air shaken or beaten into the mixture, air or gas injected in streams; gas chemically evolved throughout the mixture; gas electrolytically evolved by decomposition of the liquid; gas liberated by first increasing the amount in solution in the liquid by the use of pressure and then releasing the pressure; all described in the patents referred to by me; air or gas normally in solution in the liquid and evolved by creating a partial vacuum over its surface; or gas produced by boiling the liquid as described in patent No. 835,143, to Henry L. Sulman.

. . . . . .

"The fact that widely different amounts of the same oiling agent, indiscriminately over as well as under one per cent. or a fraction of one per cent. of the weight of the ore, may be successfully used to oil the mineral and float it by attached gas films or bubbles is shown by the prior patents referred to by me, and by the practical tests which I have made and described." (Transcript, pages 110-111.)

Dr. Byrnes' slide machine tests of the Froment process show conclusively that in the result obtained there is no difference between the use of less than 1 per cent. of oil, as in the first experiment; the use of over 3.6 per cent. oil, as in the second, third and fourth experiments; and the use of about 1.8 per cent. of oil, as in the fifth experiment.

Following is a table compiled from Dr. Byrnes' testimony showing the results obtained in his five experiments described above:

Dr. Byrnes' Froment Experiments.

Experiment No.	Weight of Oil Used.	Kind of Oil.	Per cent. of Oil Used.	Weight of Concentrate.	Per cent. of Zinc in Concentrate.	Weight of Tailings.	Per cent. of Zinc in Tailings.
1	492 grams	Cotton-seed oil	0.056%	170.5 grams	50%	315.5 grams	4.2%
2	492 grams	Cotton-seed oil	over 3.6%	211 grams	48.3%	292 grams	1%
3	492 grams	Ehrmann's California olive-oil	over 3.6%	219 grams	44.3%	274 grams	0.6%
4	492 grams	Impure oleic acid	over 3.6%	65 grams	42.2%	not weighed	not assayed
5	500 grams	A purer oleic acid	about 1.8%	202 grams	47.5%	288 grams	1.1%

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The high grade of the concentrates and especially the low content of zinc in the tailings resulting from Dr. Byrnes' experiments show the eminently successful character of his operations in experiments 2 to 5 with over 1 per cent. of oil.

Dr. Liebmann's Froment Experiments.

Dr. Liebmann, complainants' expert witness, describes (Transcript, page 296, bottom of page, to page 300) several experiments which he performed and which he states are duplicates of Dr. Byrnes' experiments. Dr. Liebmann by elaborate precautions, such as limiting the period of agitation to from two to five seconds, avoided the possibility of producing the results described by Dr. Byrnes and comes to the conclusion, as stated by him, that it is "impossible to produce the Froment result with the proportions between ore, oil and acid which Dr. Byrnes used in the slide machine experiments," and that "it is impossible with such proportions to produce the Froment result of the test-tube example" (Transcript, page 299, third paragraph). A sufficient answer to Dr. Liebmann's testimony is the fact that Dr. Byrnes did accomplish the results testified to by him; the fact that *Dr. Liebmann was obliged to resort to special precautions to avoid securing a like successful result;* and the fact that Dr. Byrnes' experiments can be reproduced with the result described by him.

Mr. Chapman's London Experiments With Over One Per Cent. of Oil.

In an effort to make it appear that a floating froth could not be obtained with oil in the quantities used by Dr. Byrnes in his Froment experiments, Minerals Separation, Limited, introduced the testimony of their engineer, Mr. George A. Chapman, regarding certain tests made in what complainants term their London standard plant (Transcript, page 388, folio 790, to top of page 392). This plant, as stated by Dr. Liebmann (Transcript, page 310, bottom of page), is the same as that shown in "Complainants' Exhibit King Johns Court Standard Plant," an illustration of which appears in the Transcript after page 556. This is a plant of the kind recommended by Minerals Separation, Limited, for the practice of the alleged new process of the patent in suit.

In this apparatus Mr. Chapman treated tailings from Broken Hill, Australia, instead of the Butte & Superior ore used by Dr. Byrnes. In his first experiment Mr. Chapman made a low recovery of the mineral contained in the ore, and in his second experiment he made a better though not a high recovery by adjusting the quantity of acid. Mr. Nutter, chief engineer for Minerals Separation, stated the fact that each ore presents a separate problem, and that when the alleged new process of the patent in suit does not work properly he would try every conceivable variation of the several steps of the process and of the quantities of the different substances employed and of all the other conditions (*supra*, pages 63 to 67). This being the case, no valid inference can be drawn from the fact that Mr. Chapman did not obtain results satisfactory to him when he applied to a

Broken Hill, Australia, zinc-lead ore the precise procedure that Dr. Byrnes had found satisfactory for the treatment of the Butte & Superior zinc ore from the mine at Butte, Montana. (Composition of Broken Hill ore, Transcript, page 388, last paragraph; composition of Butte & Superior ore, Transcript, page 56.)

Chapman's testimony regarding his failure to obtain ideal results when operating upon Australian ore by methods adapted to Montana ore serves no purpose other than to demonstrate the impossibility of producing any real evidence in rebuttal of Dr. Byrnes' testimony.

Other Deceptive Froment Experiments.

Mr. Chapman describes (Transcript, pages 392-393) two experiments which he refers to as Froment experiments.

In these alleged Froment experiments Mr. Chapman used 10 per cent. of limestone or calcite and 10 per cent. of sulphuric acid by weight relative to the ore treated, and also used Winter dark oil in an amount equal to 12.5 per cent. by weight relative to the ore. This was a perversion of the Froment process.

In the first of Chapman's alleged Froment experiments as described by him there was a violent effervescence which caused the materials to overflow from the apparatus. The reason for this violent effervescence and overflowing of the materials was that Chapman designedly used vastly more limestone and sulphuric acid than recommended by Froment. Froment in his patent particularly cautions the operator against using such an excess as will cause violent effervescence (*supra*, pages 118-120), and in the Froment description he directs the use of 1 per cent. each of carbonate and acid (Tran-

script, pages 411, 412, folios 829 and 831), instead of the 10 per cent. used by Chapman.

Another cause introduced by Chapman to bring about a failure was the use of 12.5 per cent. of Winter dark oil. This Winter dark oil is a substance not mentioned by Froment and one ill adapted for the purpose. Furthermore, Froment, in the Froment description, recommends the use of from 1 per cent. to 3.5 per cent. of oil (*supra*, page 137), and in his British patent Froment recommends the use of a thin layer of ordinary oil which, in the case of a large number of ordinary oils excellently adapted to the purpose, amounts to but a trifle over 1 per cent. relative to the weight of the ore used by Froment as admitted by complainants' witness Liebmann (*supra*, page 41).

In performing his second alleged Froment experiment Chapman used precisely the same proportions of oil and limestone as in his first experiment, but reduced proportionately the amounts of all ingredients. The result was the same as in his first experiment, namely, a violent effervescence, but by reason of the smaller quantity of the substances used the apparatus was large enough to prevent overflow. Even under these circumstances Chapman admits that he obtained "a float of about 4 or 5 inches in thickness after the violent evolution of the gas had ceased." Obviously, a float of 4 or 5 inches in thickness could have been nothing other than a froth. Operating under these extraordinary conditions, with ten times as much limestone and acid as recommended by Froment, Chapman found by analysis that the gas in the froth contained 97.15 per cent. carbon dioxide. This, however, does not demonstrate that Froment's process is one limited exclusively to the production of a froth floated wholly, or almost wholly, by carbon dioxide gas. The experiment was not performed in

accordance with Froment's directions and demonstrates nothing other than that the amount of carbon dioxide gas in the froth can be increased by using excessive amounts of limestone and sulphuric acid—amounts ten times greater than contemplated by Froment.

Higgins Produced Froth With 3.6 Per Cent. Oil.

That Dr. Liebmann's and Mr. Chapman's experiments were purposely made to result in failure to make it appear that the Froment process, or any process in which more than 1 per cent. of oil is used is inoperative, is further shown by the testimony of complainants' metallurgist, A. Howard Higgins, when testifying as complainants' witness. Mr. Higgins' testimony also shows the absolute incorrectness of the statement that a new and different phenomenon results when the quantity of oil in the old oil flotation process is reduced below 1 per cent.

Mr. Higgins (as stated above, *supra*, page 47) testified on complainants' behalf regarding an experiment performed with the ore of the Elm Orlu mine which adjoins the Black Rock mine of the Butte & Superior Copper Company. Defendant's operations upon the Black Rock ore formed the basis of the charge of infringement herein. Regarding his operations upon the Elm Orlu ore Mr. Higgins testified (Transcript, page 387) that he had made tests of that ore in a plant substantially the same as that shown in the drawings "Complainants' Exhibit King Johns Court Standard Plant" (which exhibit is reproduced in the Transcript after page 556). Higgins stated that with the exception of some clay in the Elm Orlu ore that ore is practically identical with the Black Rock ore. In his experiment Higgins testifies that he crushed the Elm Orlu ore to 80

mesh and used the same proportions of sulphuric acid and cotton-seed oil as used by Dr. Byrnes in his Froment second slide machine test (described by Dr. Byrnes at page 108 of the Transcript, paragraph beginning at line 6). With oil in this amount, namely, 3.6 per cent. by weight relative to the ore, Higgins made his test, and the following is quoted from his description of the result (Transcript, page 387):

> ". . . In about three minutes the plant had settled into a permanent condition. The float on the first spitzkasten was copious, being only about one inch to an inch and a half deep, and, though oily in appearance when closely examined, did not differ in appearance from the usual agitation froth at a distance of a few feet." (Transcript, page 387.)

The concentrates obtained by Mr. Higgins contained, as stated by him, 47.54 per cent. zinc, which is a high-grade concentrate. The recovery effected by Mr. Higgins in this operation was 50 per cent.—not a high recovery but one that could be increased by proper mill methods if the ore is one adapted to flotation concentration. Furthermore, Higgins applied to the Elm Orlu ore the precise procedure that Dr. Byrnes had used in treating the Butte and Superior ore, notwithstanding the difference between the two ores which he mentioned. This was contrary to the elementary knowledge of every metallurgist, as is made clear by Mr. Nutter's testimony (*supra,* page 66), that each ore presents a separate problem.

Dr. Byrnes' Understanding of Froment Patent Confirmed by Froment Description.

At the time he testified, defendant's expert, Dr. Byrnes, knew nothing of the existence of the Froment description, which document was introduced in evidence later by complainants. In determining the amounts of oil to be used, Dr. Brynes relied solely upon the instructions contained in the Froment patent, and in pursuance thereof used from a fraction of 1 per cent. of oil by weight relative to ore up to 3.6 per cent. Dr. Byrnes' understanding of the Froment British patent, as to the amount of oil to be used, is corroborated and shown to have been absolutely correct by the Froment description, of which he had no knowledge when testifying, wherein the amount of oil is stated as from 1 per cent. to 3½ per cent. (*Supra*, page 137.)

The Froment description also confirms Dr. Byrnes' testimony that in the operation of the Froment process air would necessarily be introduced into the pulp by the agitation described in the Froment British patent. The Froment apparatus and its mode of operation are precisely like that recommended and used by complainants and necessarily would produce the same result (*supra*, pages 140, 141). That this is the case is specifically admitted by William H. Ballantyne (*supra*, page 142), a metallurgical engineer who acts as complainants' patent solicitor and who testified on behalf of complainants.

Carbonic Acid Gas in Froths Produced by Process of Patent in Suit.

In an effort to fortify the contention that there is a distinction between the Froment process and that of the patent in suit, Dr. Liebmann made several analyses of the gases contained in the froths obtained in his experiments. Dr. Liebmann applied the alleged new process of the patent in suit to the San Francisco del Oro ore and found that the froth contained 77.5 per cent. of air and 22.5 per cent. of carbonic acid gas (Transcript, page 312, near middle of page). Even this experiment, selected for presentation to the court by Minerals Separation, Limited, resulted in a froth supported by a gas over one-fifth of which was carbonic acid gas. Furthermore, the San Francisco del Oro ore contains, as stated by Dr. Liebmann, from 4 to 5 per cent. of calcite or limestone (*supra*, page 127). The Froment description (Transcript, page 411, below middle of page) following the recommendation of the Froment British patent that a proportion be sought as to the amount of limestone, recommended the use of only 1 per cent. of limestone or calcite and a maximum of 2 per cent. in difficult cases. It is, therefore, quite apparent that carbon dioxide gas, the quantity of which is related directly to the quantity of limestone or calcite, entered much mo. e largely into the application of the alleged new process of Minerals Separation, Limited, to the San Francisco del Oro ore than into the Froment process, and, according to the testimony of their witness, Wincey, practically all of complainants' operations are conducted with ores containing from 1 to 3 per cent. of calcite or limestone (*supra*, page 122), which is as much as is recommended by Froment.

Dr. Liebmann also performed an experiment applying the process of the patent in suit to "Defendant's Feed to Flotation Plant," this being the material used by defendant in the operations upon which the charge of infringement is based. Dr. Liebmann (Transcript, page 312) says that he treated this material by the process of the patent in suit and found that the gas in the froth consisted of 90.7 per cent. air and 9.3 per cent. carbonic acid gas. Dr. Liebmann performed other experiments wherein the amount of carbonic acid gas varied, and in one instance he found no carbonic acid gas at all. By means of suitable precautions a froth can be formed with almost any gas. But Dr. Liebmann's experiments with the San Francisco del Oro ore and with "Defendant's Feed to Flotation Plant" confirm our contention that both air and carbonic acid gas enter into the froth formed in the practice of the alleged new process of the patent in suit in the same way that such gases enter into the froth produced by the Froment process.

Dr. Byrnes stated (Transcript, page 115, near bottom of page) that throughout the Black Rock mine of the Butte & Superior Copper Company, from which the ore was obtained which was treated by Mr. Hyde, he found manganese carbonate, mineralogically known as rhodochrosite, to be prevalent, and that in many places it occurs in large veins and masses and often in the body of the richest zinc sulphide.

No Possibility of a Difference Between Froment Process and Process of Patent in Suit as Applied to San Francisco del Oro and Australian Ores.

Not only, as a matter of practice, does the use of the alleged new process of the patent in suit involve the generation and utilization of as much and in some instances more carbonic acid gas than directed by Froment, but it necessarily could not be otherwise. Both Mr. Sulman and Dr. Liebmann testify that acidity is necessary in the pulp when treated by the process of the patent in suit. Following is their testimony on this point:

> ". . . as to the acidity, this can be determined instantly by means of Litmus paper, or other suitable indicator, it only being necessary to have a slight degree of acidity present in the pulp." (Sulman, Transcript, page 139, bottom of page.)
>
> ". . . The object of the patentee is to have an acid reaction; that means, the faintest quantity of acid present during the process of oiling." (Liebmann, Transcript, pages 318-319, passage beginning at bottom of page 318.)

Now, as above set forth, the Australian ores treated by Minerals Separation, Limited, contained from 1 per cent to 3 per cent. calcite, which is limestone, and the San Francisco del Oro ore contained 5 per cent. calcite.

Dr. Liebmann made the following statement regarding the reaction between calcite or limestone and sulphuric acid:

> "It is well known to chemists and metallurgists that in such operations as the action of sulphuric acid on limestone, the evolution of carbonic acid gas is instantaneous if you operate in such a manner that you bring the whole of the limestone into intimate contact with the whole of the acid." (Liebmann, Transcript, page 351, last paragraph.)

Mr. Chapman made the following statement regarding the reaction between sulphuric acid and limestone or calcite in the operations of Minerals Separation, Limited, on the San Francisco del Oro ore:

> "The 60 or 70 lbs. of acid per ton of ore which was used at the Emu, Wales, plant was immediately consumed by the calcite . . ." (Chapman, Transcript, page 200, lines 5 and 6.)

It is apparent that as limestone or calcite, to the extent to which it is present, immediately consumes sulphuric acid with the generation of carbonic acid gas, the acidity which Mr. Sulman and Dr. Liebmann say is necessary in the process of the patent in suit can be obtained only by adding a little more sulphuric acid than will be consumed by the limestone. There is no controversy on this point. Mr. Chapman testified that Minerals Separation, Limited, had "never been able to treat ores with calcitic gangue in disturbing quantities without a very large consumption of sulphuric acid." (Transcript, page 204, bottom of page.)

From the foregoing it will be apparent that in the Australian operations of Minerals Separation, Limited, and in the operation upon the San Francisco del Oro ore there could by no possibility be any difference between the Froment process and the process of the patent in suit. Froment recommended the use of 1 per cent. of calcite and 1% of sulphuric acid to consume it. The Australian and San Francisco del Oro ores contain from 1 to 5 per cent. of calcite and the witnesses and employees of Minerals Separation, Limited, admit that they were obliged to use enough sulphuric acid to consume the calcite in order that the pulp should be given an acid reaction.

The operations and substances employed in the two processes are the same. The only possible distinction

is in the fact that Froment laid stress on carbonic acid gas as the main agency of flotation, while the patent in suit contains the statement that the froth or scum "derived its power of flotation mainly from the inclusion of air-bubbles" (Transcript, page 476, next to last paragraph). This difference in theory is immaterial. Both air and carbonic gas enter into the froth whether the process be called "Froment" or "Minerals Separation," as shown by Dr. Liebmann's experiments. (*Supra*, pages 157, 158.)

Froment Process Produces Same Froth as Alleged Process of Patent in Suit.

The expert witnesses for Minerals Separation, Limited, evidently in an effort to creat the impression that what they called the "agitation froth" produced by the alleged new process of the patent in suit is a phenomenon never produced before the alleged invention thereof by the grantees of the patent in suit, have indulged in a large amount of theorizing. The following quotations are representative of the testimony referred to:

Dr. Liebmann testified as follows regarding the froth produced by the Froment process:

> ". . . A superficial observation would perhaps give the impression that it had the appearance of a froth, but it is not a froth. It is only a layer of oil in which minerals and carbonic acid bubbles are embedded." (Transcript, page 286, middle of page.)
>
> ". . . There may be what is popularly called a froth, but this froth differs in characteristic qualities from the froth produced with the quantities of oil described by the patentees of the patent in suit as suitable and economical." (Transcript, page 305, near bottom of page.)

Mr. Sulman commented as follows upon the froth produced by the Froment process:

> ". . . I have heard the float mineral produced by the Froment reaction described as a froth, but it is a tender and evanescent assemblage of bubbles of carbon dioxide carrying mineral, and is not comparable in nature or character with the agitation froth described in the patent in suit." (Sulman, Transcript, bottom of page 133 and top of page 134.)

In the testimony quoted above the witnesses for Minerals Separation, Limited, admit that the Froment process produces a float consisting of bubbles and carrying mineral, and admit that it has been described as a froth, has the appearance of a froth and may be what is popularly called a froth, but still is not a froth. They do not point out any difference. They merely assert that there is a difference. A difference that is too attenuated to be seen or discerned by any test may fairly be said to be imaginary.

Minerals Separation, Limited, Admits Froment Process Produces a Froth.

That the refinements and contradictions contained in this testimony result from an attempt to make something out of nothing is further demonstrated by the statements of Minerals Separation, Limited, one of the complainants, in a British patent granted to that corporation jointly with another in the year 1910. In the year 1910 British patent 23,870 (reproduced in the Transcript at page 542) was granted to Minerals Separation, Limited, and Edward H. Nutter jointly. This patent is for a modification of the flotation process whereby it is sought to effect a classification of the metalliferous mineral contained in an ore by producing

a series of froths formed under different conditions. As appears from the following quotations from this British patent, the patentees stated that the froths might be produced by any one of several processes, including the processes of British patent 7803 of 1905 (reproduced in the Transcript at page 533), which is the British patent corresponding to the United States patent here in suit (Transcript, pages 233 and 339), and British patent 12,778 of 1902, which is the Froment British patent. (Transcript, page 706.) The 1910 British patent granted to Minerals Separation, Limited, and Nutter also contains a statement, quoted below, that the process of that patent may be performed in an apparatus comprising a series of preliminary mixers connected to spitzkasten or separating boxes for the collection of the froth. This is precisely the kind of apparatus described in the patent here in suit. Following we quote from the British 1910 patent the passages referred to:

> "The processes employed to obtain these froths or scums may be any of the well-known flotation processes, as described, for example, in patents Nos. 12,778/02, 29,374/04, 7803/05, 26,852/08, 28,-173/08, 2359/09, *et cetera.*" (Transcript, page 544, middle of page.)
>
> . . . . . .
>
> "This process can be carried out in an apparatus comprising a series of preliminary mixers connected to spitzkasten or separating boxes for the collection of the froth with successive series of mixers to which the froths are supplied for retreatment." (Transcript, page 546, just below middle of page.)

From the foregoing it will be apparent that in the year 1910, at which time no legal or other situation existed to cause Minerals Separation, Limited, to depart from a fair and candid expression of the truth, that organization freely admitted in its British patent 23,870

of 1910 that the process of the British Froment patent was among the well-known processes for obtaining the flotation of the valuable parts of a mineral in the form of a floating froth or scum, and that the Froment process could be carried out in precisely the same kind of apparatus which is described in the patent in suit.

In the year 1912, being involved in this litigation, wherein it is vital to their financial interests that they cloak the pretended invention of the patent in suit with a semblance of novelty, they produced metallurgists and expert witnesses who testified to a condition precisely the opposite of the truth admitted by Minerals Separation, Limited, in 1910.

Froment Process Identical With Process of Patent in Suit.

The Froment procedure and apparatus as described in his patent and in the Froment description is identical in principle and operation with the procedure and apparatus used in practice by complainants and by defendant, and the apparatus illustrated and described in the Froment description is much more like that used in practice than is that described and shown in the patent in suit.

The attempt by Minerals Separation, Limited, to show that their process utilizes and depends upon air, while Froment's depends upon carbonic acid gas, is not founded in fact. Each process utilizes both gases. Froment referred to "any gas" and to carbonic acid gas, but he described apparatus and procedure which inevitably introduce air by agitation and utilize the air so introduced.

As a matter of fact, complainants' alleged new process is identical with the prior art and Froment's process. Froment merely added to the prior art an explanation of

the part played by carbon dioxide in supplementing the effect produced by the agitation which forms part of every oil flotation process from Haynes' process of 1860 to the present time. For convenience of comparison, we present the following parallel column statement of the Froment process and the alleged new process of the patent in suit:

Froment Process.	Process of Patent in Suit.
Preparation of Ore Pulp.	*Preparation of Ore Pulp.*
The powdered ore is mixed with sufficient water to form a freely flowing pulp. (Froment patent, 10 grams of ore and 30 grams of water, Transcript, page 706; Froment description, 6 litres of water to 2½ kilograms of ore, Transcript, page 410, fourth paragraph.)	The powdered ore is mixed with sufficient water to form a freely flowing pulp. (Specification and claims of patent in suit, Transcript, page 475.)
Oil—Amount of.	*Oil—Amount of.*
Oil is recommended in the Froment description in an amount equal to from .1% to 3.5% of the ore by weight; in the Froment patent "a thin layer" of oil is recommended, which with different oils would amount to from a little over 1% to 12.5%, and the result sought is clearly defined, thus enabling the metallurgist to properly adjust the quantity of oil. (Froment description, Transcript, pages 411-412; Froment patent, Transcript, page 706.)	The patent in suit recommends a fraction of one per cent. of oil, but complainants' witness Higgins admitted that the same result was obtained upon the Elm Orlu ore with 3.6% of oil, and Dr. Byrnes and Mr. Hyde produced the same froth by means of oil in quantities varying from less than one per cent. to twenty-five per cent. (*Supra*, pages 46, 47, 154, 146 to 150, and *post*, page 185.)

Froment Process.

Oil—Kind of.

Froment recommends the use of "ordinary oil" (Froment patent, Transcript, page 708), or a "suitable oil" (Froment patent claim, Transcript, page 709), and mentions "an oily fat body" (claim of Froment Italian patent, Transcript, page 474).

Agitation.

Froment in his British patent directs agitation for a brief space (Transcript, page 708), and in the Froment description he directs agitation for about ten minutes. (Transcript, page 411, below middle of page.)

The agitation vessel illustrated in the Froment plan is, according to the scale of that drawing, about 3 feet in diameter, and the Froment description contains directions that the agitators be revolved at 300 revolutions per minute. (*Supra*, pages 141, 142.)

The Froment description and plan contain a description and illustration of agitating apparatus which complainants' witness, Ballantyne, admits would beat air into the mixture if used as recommended by Froment and that this constitutes the first step of the Froment process. (*Supra*, page 142.)

Process of Patent in Suit.

Oil—Kind of.

The patent in suit mentions oils, fatty acids and oleic acid.

Agitation.

The patent in suit directs that the mixture be briskly agitated as in the Cattermole process for about two and a half to ten minutes. (Transcript, page 476, just below middle of page.)

Complainants' witness Wincey (*supra*, page 141) testified that in Australia complainants use agitating boxes 3 feet square and that the agitators are run at a speed of from 265 to 270 revolutions per minute.

The patent in suit refers to the use of a "cone-mixer" and contains an illustration of a vessel containing a rotatable conical stirrer. No baffles are shown or described, although according to the testimony of complainants' witnesses such baffles are essential for the introduction of air. (*Supra*, pages 56-60.)

Froment Process.	Process of Patent in Suit.
Acid.	*Acid.*
Sulfuric acid is recommended. (Froment patent, Transcript, page 708; Froment description, page 412, middle of page.)	Sulfuric acid recommended. (Transcript, page 476, top of page.)
Acid—Amount of.	*Acid—Amount of.*
Froment in his patents directed the use of a few drops of sulphuric acid, which amount would react upon but a small part of the one gram of limestone recommended. (Transcript, page 708; *supra*, pages 123, 124.) Froment in the Froment description directs the use of 1% of limestone and 2% in difficult cases, and recommends the same proportions of sulphuric acid, *i. e.*, 1% of sulphuric acid when 1% of limestone is present. (Transcript, page 411, below middle of page, and page 412, middle of page.)	According to the patent in suit and the interpretation thereof by complainants' witnesses a little more than enough sulfuric acid is to be used to react with all of the limestone present so as to leave a little free sulphuric acid in the mixture. Complainants' operations have been upon ores containing from 1% to 5% of limestone and thus involved in most cases the use of more sulphuric acid and the generation of more carbonic acid gas than in the Froment process. (*Supra*, pages 122, 123, 124, 127, 128.)
Order of Operations.	*Order of Operations.*
Froment in his patents recommends admixture of all the substances including acid before agitation (Transcript, page 708), and in the Froment description he describes the alternative procedure of agitating before adding acid. (Transcript, page	The patent in suit describes an operation in which all of the substances including acid are mixed before agitation, and complainants' chief engineer Nutter says that complainants' process consists in agitating either before or after the addition of acid

Froment Process.	Process of Patent in Suit.
412, paragraph beginning "Whilst the mixing device . . ."	(Transcript, page 43; *supra*, page 64.)
Result to Which Process Is Directed.	*Result to Which Process Is Directed.*
The formation of bubbles of gas which become covered with an envelope of sulphides and rise to the surface of the water in which the ore is suspended (Froment patent, Transcript, page 708, paragraph numbered "3").	The formation of bubbles which become covered with an armor of mineral particles and rise to the surface. (Liebmann, Transcript, page 268, first paragraph; Chandler, page 382, next to last paragraph.)
Complainant, Minerals Separation, Limited, in British patent 23,870 of 1910 recommends the Froment process as described in Froment British patent 12,778 of 1902 as a suitable flotation process for forming froths or scums of floating concentrates, and a simple demonstration shows that the Froment process does in fact produce that result. (*Supra*, pages 162-163.)	The patent in suit contains a statement that the concentrates float in the form of a froth or scum. (Transcript, page 475, last paragraph.)
Theory of Operation.	*Theory of Operation.*
Froment in his patents says that if gas of any kind is liberated in the mixture of ore, oil, acid and water, bubbles covered with an envelope of sulphides will rise to the surface, and he describes a test tube demonstration in which the mixture is agi-	In the patent in suit it is stated that the sulphide covered bubbles forming the froth derive their power of flotation *mainly* from the inclusion of air beaten in by the agitation. (Transcript, page 476, next to last paragraph.) The use of the word

Froment Process.

tated, thus necessarily introducing air, and in which carbonic acid gas is generated. (Transcript, page 708, paragraph numbered "3", and following.)

In the Froment description Froment describes such agitation as would result in air being beaten into the mixture, as admitted by complainants' witness, Ballantyne, and directs the addition of 1% of acid to react with the 1% of limestone present to generate carbonic acid gas. (*Supra*, pages 140-142, and Transcript, pages 411, below middle of page, and 412, just below middle of page.)

Process of Patent in Suit.

"mainly" in an admission of the presence of other gases, and the presence of carbonic acid gas is shown in substantial quantities by the testimony of witnesses for Minerals Separation, Limited. Moreover, the fact that Minerals Separation, Limited, in the application of their process have more limestone present and use more acid than recommended by Froment demonstrates that carbonic acid gas must play a greater part in their process than in Froment's. In the application of complainants' process to the San Francisco del Oro ore they generated enough carbonic acid gas to float six or seven times the weight of the entire ore treated. (*Supra*, pages 127, 128, 157.)

Complainants' bottle test for the purpose of ascertaining the applicability of their alleged process to an ore is identical with the test tube operation described in the Froment British patent 12,778 of 1902 (*supra, pages* 120, 121.)

Glogner U. S. Patent 736,381, August 8, 1903.

(Transcript, page 629.)

The patent in suit contains a statement that the alleged new process thereof is useful for the separation of graphite (Transcript, page 475, second paragraph), but the oil flotation process had long before been applied to the separation of graphite from the earthy materials

with which it occurs in nature. Such a process is set forth in the patent to M. F. R. Glogner, No. 736,381, granted August 8, 1903 (Transcript, page 629). According to Glogner's invention he first separates the heavier impurities, such as quartz or iron, leaving only the earthy materials with the graphite. For the purpose of carrying out his process he describes and illustrates suspended vessels having an inclined bottom, in which the mixture of oil, ore and water is agitated by hand. He states that *the mixture is thoroughly stirred* within the closed vessel (Transcript, page 629, line 6 from bottom of page). In another place (Transcript, page 630, line 20) he refers to the agitation as *"thorough mixing."* He states that the vessels are agitated in short shocks, about thirty per minute (Transcript, page 630, last paragraph). His description of the process is most clearly set forth in his own language:

> "The mixture containing only fine earthy substances and graphite is mixed with a quantity of water the weight of which is about three or four times as great as that of the graphite mixture. Petroleum is then added in the approximate proportion of *one part petroleum to two parts of graphite* contained in the mixture. Now the whole is given a strong rotating, rocking, or reciprocating movement within a closed vessel, so that the mixture is thoroughly stirred and intimately mingled. *The petroleum is broken up into very fine drops or perles, and every graphite particle when touching them is attracted, while the earthy particles, which were already saturated with water before the addition of petroleum, remain completely neutral.* After the vessel has been allowed to stand the earthy parts sink down, while the petroleum carrying the graphite tends to rise to the surface. After a certain time water is then sprinkled over the surface of the liquid by means of a rose or the like, whereby the fine earthy particles are caused to sink more quickly, *and any earthy particles which may be carried upward*

by the rising petroleum and froth are caused to sink down again." (Transcript, page 631, first paragraph.) (Italics ours.)

It will be noticed that in the foregoing quotation Glogner refers to sprinkling the surface of the water to promote sinking of the earthy particles which might be carried upward by the rising petroleum and *froth*. Glogner states (Transcript, page 631, third paragraph) that it is possible by his process to work graphite mixtures which contain only 10 per cent. graphite. The amount of oil added to the ore is defined in the patent (passage quoted above) as one part of oil to two parts of graphite. In operating upon ore containing 10 per cent. graphite, therefore, the amount of oil used would be 5 per cent. upon the weight of the ore.

The small amount of oil used by Glogner and the thorough mixing and breaking of the petroleum "into very fine drops or perles" referred to by him preclude the possibility of his process being a bulk oil process of the Elmore type. That it was not a film or skin flotation process is shown by Glogner's reference in the passage above quoted to "the rising petroleum and froth." Not only does Glogner refer to the float as a "froth," but the conditions of his process could not have resulted in any other kind of flotation.

Schwarz U. S. Patent 807,503.

(Transcript, page 667.)

Another application of the oil flotation process is disclosed in this patent, which was applied for May 27, 1904, and granted December 19, 1905. The patentee states that he has found that the efficiency of the selective action of oils generally, either mineral, vegetable or animal, is increased by the addition thereto of a

fatty matter which is solid at normal temperatures, as paraffin, stearin, or palmitin. According to Schwarz the ore is first crushed and screened, then intimately mixed with a compound of a mineral, vegetable or animal oil, and a fatty matter which is solid at normal temperature. Heat is employed to melt the solid fatty matter, if necessary, and to maintain the compound in a liquid condition. Schwarz also states that any suitable mechanism may be employed to effect the mixture of oil and selective material, all that is essential being a vessel provided with agitating blades. In such vessel, which may be steam-jacketed, the ore is mixed with the selective material to make a thick, pasty mass, then agitated with water, whereupon the selective material, with the metallic constituents of the ore, is removed by floating it over the top of the vessel. Better results may be secured, the patentee states, by the injection of a gaseous fluid, such as air, steam or other gas, for instance, carbon dioxid gas, the selective material taking up an appreciable quantity of the air or gas, and thus acquiring a certain amount of sponginess, which increases its floating power.

The drawing of the Schwarz patent shows a steam-jacketed vessel provided with an agitator in which the ore is agitated with oil, and a second similar vessel having an agitator in which the mixture of the oil and ore is mixed with acidulated water, which may be heated. In this second vessel means are provided for injecting air, steam or other gas. The second vessel is provided with an overflow spout at the top to carry off the floating oil and mineral, and a centrifugal separator is provided for separating the oil from the mineral. Schwarz also states, in the patent referred to, that the tailings may be subjected to further treatment for the

recovery of any values not recovered by the first treatment.

Dr. Byrnes, in his summing up of Schwarz patent No. 807,503, stated:

"(1) The selective action of oil generally, mineral, vegetable or animal, for the metalliferous constituents of ore, especially sulfid ores.

"(2) The use for oiling the mineral of an oil containing a fatty matter which is solid at normal temperatures, such as stearin; and of a mixture of an oil, which may be animal oil, and a fatty matter, which may be stearin, which is solid at normal temperatures. 'Red oil,' the commercial form of impure oleic acid produced by the candle and soap maker, is a mixture of this character, containing stearic and palmitic compounds, and being entirely solid at the lower range of atmospheric temperatures.

"(3) The use of a sufficient quantity of the oil or oily mixture to effect the desired separation, that is, the oiling and floating of the metalliferous constituents.

"(4) The use of slightly acidulated water to prevent the adhesion of the oil or oily mixture to the gangue or tailings, that is, to increase its selective action or preferential affinity for the mineral.

"(5) The thorough mechanical agitation of the ore with the oily material and with the acidulated water, as by agitating blades, in open vessels, which agitation will not only thoroughly distribute the oil throughout the ore and cause it to coat the mineral particles, but will also entangle the atmospheric air and thoroughly aerate the mixture to produce a floating froth of concentrates.

"(6) Further aeration of the mixture by the injection of streams of air, steam or carbon dioxide gas, giving the froth sponginess and increased floating power, thus floating some of the oiled mineral which might otherwise remain in the tailings and necessitate their reaeration in a subsequent operation.

"(7) The heating of the mass, as by steam-jacketing the agitator vessel, or using heated or boil-

ing water, to maintain the oiling agent in a liquid condition.

"(8) The flotation of the aerated and spongy mass of the selective material, or oiling agent, with the entrapped metallic constituents of the ore, and its delivery to a centrifugal filter, the tailings being settled out and withdrawn at the bottom.

"(9) The retreatment of the tailings, if necessary, for the recovery of any values therein contained." (Transcript, pages 101-102.)

Dr. Byrnes performed two experiments in accordance with the directions of the Schwarz patent. Below we quote his description of these experiments, the same appearing at page 106 of the Transcript, beginning at line 4:

"By the use of this same Hyde slide machine, I have also carried out the process of the Schwarz patents 807,501 and 807,503, thoroughly mixing the ore with oil before agitating and aerating the mass to produce the froth of concentrates. For this purpose I took 500 grams of the pulverized 'Black Rock' ore, assaying 20.3 zinc added 20 cc. of cotton-seed oil and mixed the whole thoroughly with a blade, giving a homogeneous mass having the consistency of molding sand. The slide apparatus was then filled to the normal level with 1700 cc. of water acidulated with one cc. of sulfuric acid, its temperature being 76° F. The oiled ore was added and the mixture was then agitated for thirty seconds by driving the vertical shaft with radial agitating blades. A heavy froth was produced and removed. The mass was then reagitated for the same period, another froth made and removed, and this operation repeated until six froths had been separated. These froths, combined, were filtered and dried, and their weight was found to be 230 grams. The assayer reported their contents of zinc as 41.7 per cent. The assayer to whom I refer was W. R. Hocking, manager of 'The Rombauer Assay Co.,' of Butte, Montana. The tailings from these operations were also removed and dried, and their weight was found to be 277 grams, containing, as reported

by the assayer, 0.7 per cent. of zinc. These tailings were nearly white and it was evident to the eye that the metalliferous constituents thereof had been almost entirely removed. In this experiment, I did not inject a gaseous fluid, such as air, steam, or carbon dioxid, which Schwarz states may optionally be used, relying simply on the agitation to effect the production of a froth. The specific gravity of cotton-seed oil being about 0.9, the 20 cc. which I used in this test was about 18 grams, or 3.6 per cent. of the ore treated. The zinc being present in the ore in the form of its sulfid, a content of 20 per cent. of zinc, as reported, corresponds to a content of its sulfid of about 30 per cent. The 500 grams of ore therefore contained about 150 grams of the zinc sulfid, and the 18 grams of cotton-seed oil were thus 12 per cent. of this metalliferous constituent of the ore." (Transcript, page 106.)

Kirby Process.

The Kirby patent 809,959 (Transcript, page 671) was granted January 16, 1906, ten months before the grant of the patent in suit, and the application for the Kirby patent was filed December 14, 1903—a year and a half before the application for the patent in suit was filed, the latter not being filed until May 29, 1905. The grantees of the patent in suit filed the application for British patent 7803 of 1905 (Transcript, page 533) for the subject-matter of the patent in suit on April 12, 1905, a little over a month prior to the filing of the application for the patent in suit.

A certified copy of the application for the Kirby patent, duly authenticated by the Patent Office, was offered in evidence by defendant (Transcript, page 120), and it has been stipulated (Transcript, page 395) that the dates of filing appearing upon printed copies of patents introduced in evidence shall be evidence of such

filing dates. Thus, under Section 4892 of the Revised Statutes, the date of filing of the Kirby application and the date of Kirby's invention and of knowledge thereof in this country are proved as December 14, 1903.

The Kirby process, therefore, so far as it is the same as that of the patent in suit, is a bar to the validity of that patent. The law upon this point is well settled by decisions of this court, which have been uniformly followed by the lower courts and by the Patent Office ever since the patent statutes were enacted in their present form. As petitioners have raised some question in this regard, we have reviewed the cases (*post*, pages 214 to 250). Following are Sections 4886 and 4892 and the pertinent part of Section 4920 of the Revised Statutes:

> "Sec. 4886. Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor. . . ." (Revised Statutes, Section 4886.)
>
> "Sec. 4892. The applicant shall make oath that he does verily believe himself to be the original and first inventor or discoverer of the art, machine, manufacture, composition, or improvement for which he solicits a patent; that he does not know and does not believe that the same was ever before known or used; and shall state of what country he is a citizen. Such oath may be made before any person within the United States authorized by law to administer oaths, or, when the applicant resides

in a foreign country, before any minister, chargé de affaires, consul, or commercial agent holding commission under the Government of the United States, or before any notary public, judge, or magistrate having an official seal and authorized to administer oaths in the foreign country in which the applicant may be, whose authority shall be proved by certificate of a diplomatic or consular officer of the United States." (Revised Statutes, Section 4892.)

"Sec. 4920. In any action for infringement the defendant may plead the general issue, and . . . may prove on trial . . .

"Fourth. That he (the patentee) was not the original and first inventor or discoverer of any material and substantial part of the thing patented." (Revised Statutes, Section 4920.)

Kirby in his patent, in speaking of the relation of his invention to the prior art, says:

"The invention relates to the concentration of ores. It may be employed to separate the metallic minerals from the gangue, or to separate certain of the metallic minerals from others or from others and the gangue.

"The operation of the process is dependent upon the fact that, because of differences in physical characteristics of the various constituents of mineral material, such constituents show preferences of adhesion between two commingled but immiscible liquids." (Transcript, page 671, second and third paragraphs.)

Kirby was dealing with a particular ore of which he had knowledge, and while stating that "the process is applicable to a great variety of ores" (Transcript, page 671, bottom of page) he also stated that

"It is obviously impossible, however, to give definite directions for attaining the best results with all ores, because of the great chemical and physical differences which they exhibit" (Transcript, page 672, lines 7-10).

Kirby does, however, give detailed directions for treating one kind of ore, namely, the "Rossland, British Co-

lumbia, ores," with which he had done most of his work. In this connection he says:

> "The process, as an entirety, in its best form for use with Rossland ores for the purpose stated consists in the following steps:
>
> "First, in *thoroughly agitating* together (*a*) the pulverized ore or mineral material, (*b*) enough water to make with said pulverized ore a flowing pulp, and (*c*) a solution of bitumen in a thin distillable hydrocarbon liquid as kerosene, these materials to be so thoroughly agitated together as to finely subdivide said solution into small globules and bring said globules into contact with substantially all of the pulverized mineral particles which will, by preference, adhere to them.
>
> "Second, in allowing the hydrocarbon-coated particles to float to the surface of the mass . . ." (Transcript, page 672.) (Italics ours.)

Kirby—like the patentees of the patent in suit—realized that the first agitation which was violent in character coats all of the mineral particles with oil; suggests that all of these particles do not at first rise to the surface, and describes a supplementary or additional operation for the recovery of such mineral particles as are entrapped in the gangue, where he says, immediately after the passage last above quoted:

> ". . . and in rendering this separation substantially complete by gently agitating the mass, and by injecting gas into the same, and preferably also discharging into the mass fine streams of the solution." (Transcript, page 672.)

Kirby, therefore, in his patent disclosed a process which when actually carried out in literal compliance with his directions produces a froth or scum of floating concentrate composed of mineral particles coated

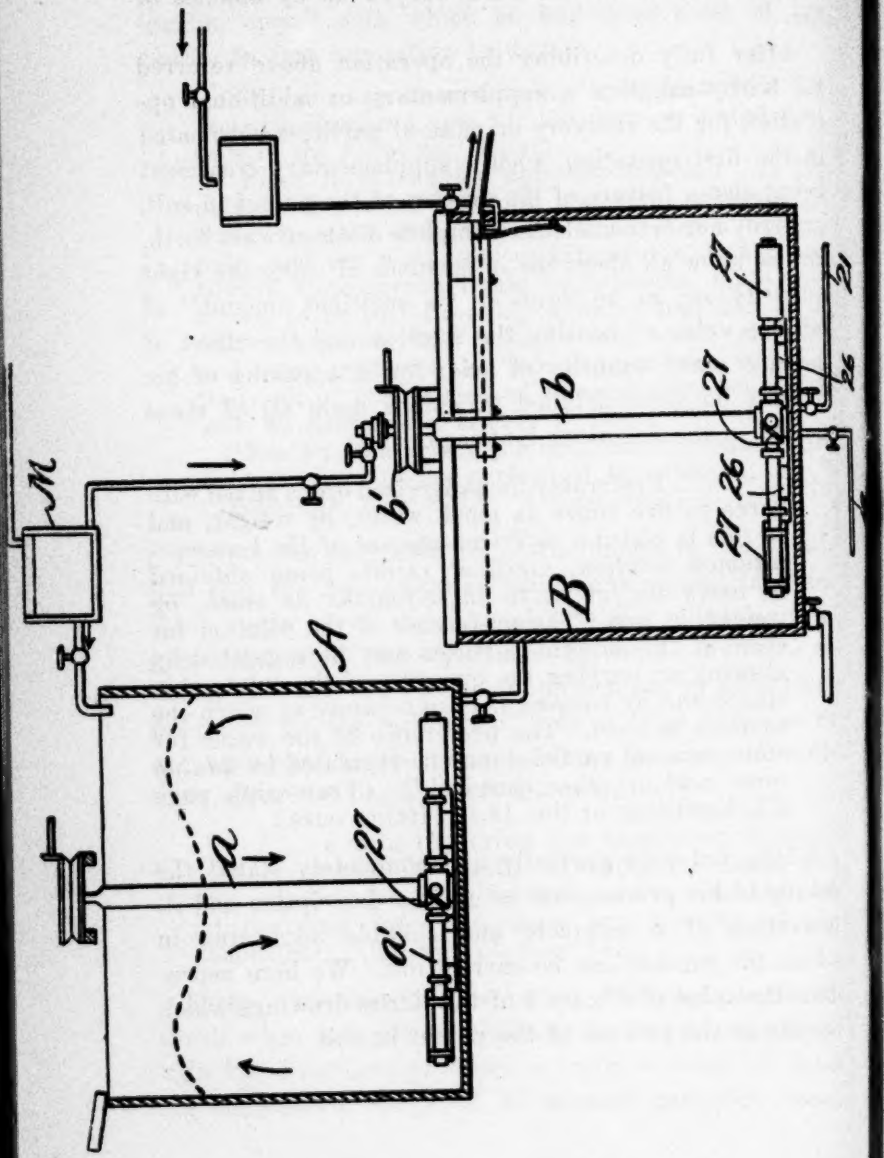
with oil and attached to and buoyed up by bubbles of air.

After fully describing the operation above referred to, Kirby suggests a supplementary or additional operation for the recovery of mineral particles not floated in the first operation, such a supplementary treatment being also a feature of the process of the patent in suit.

Kirby not only made the complete disclosure set forth, but he knew all about the importance of using the right quantity, or, as he terms it, "a sufficient amount" of oil, the value of heating the solution and the effect of using a small quantity of acid, for in speaking of his process he gives detailed directions upon all of these points in the following language:

> ". . . Preferably the pulverized ore is mixed with three to five times as much water, by weight, and to this is added a *sufficient amount of the kerosene-bitumen solution, excellent results being obtained by using one-fourth to three-fourths as much, by weight, as ore.* The preference of the solution for some of the mineral particles may be regulated by altering or varying the quantity of the solute substance and by *varying the temperature* at which the solution is used. The preference of the water for other mineral particles may be regulated by *adding some acid* or other chemical." (Transcript, page 673, beginning at line 14.) (Italics ours.)

Kirby not only perfectly and completely stated the details of his process, but he gives a description and illustration of a complete and suitable apparatus in which the process can be carried out. We here reproduce that part of Figure 1 of the Kirby drawings which relates to the process of the patent in suit.


M
A
B
a
a'
b
b'
27
26
21

The part of the Kirby drawing here reproduced shows two similar tanks, designated A and B, each of these tanks being provided with a rotary agitator or mixer. Kirby refers to the tank A as a mixing tank and the tank B as a separating tank (Transcript, page 674), but states that the "separate tank for performing the mixing operation is not necessary" (Transcript, page 676, lines 6 and 7). As described by Kirby (Transcript, page 675, paragraph beginning at bottom of page), there is mounted in the mixing tank A a vertical rotating shaft *a* having radial arms a^1, or plows, attached to its lower end. The tank B (Transcript, page 674, last paragraph) is the same as tank A, except that air and oil can be injected through the hollow rotary vertical shaft for carrying out the second and supplementary stage referred to by Kirby in the following passages of his patent:

> ". . . and in rendering this separation substantially complete by gently agitating the mass, and by injecting gas into the same, and preferably also discharging into the mass fine streams of the solution. . . ." (Transcript, page 672, just below middle of page.)
>
> ". . . the injection of a gas, preferably air, into the mass, which [is] the chief novel characteristic of the second step of the process, assists in the flotation of the hydrocarbon-coated particles." (Transcript, page 673, middle of page.)

To accomplish the thorough agitation which is the first step of this process (Transcript, page 672, line 19) Kirby gives the following directions in connection with the use of his apparatus above illustrated:

> "This shaft *a* is to be rotated rapidly, and the result is a thorough commingling of the various parts of the charge, which result is facilitated by the currents created in the charge by the action of said plows, the direction of said currents being

indicated by the arrows in Fig. 1." (Transcript, page 676, lines 2-6.)

The arrows referred to by Kirby appear in the part of his drawing above reproduced, and these arrows, as well as the dotted lines showing the surface of the pulp, indicate the vortex which is always formed by the rapid rotation of an agitator such as described by him.

Kirby, like the patentees of the patent in suit, thought that operations additional to those above described would effect a more complete separation of the mineral, and upon this point makes the following statement:

> ". . . the injection of a gas, preferably air, into the mass which the chief novel characteristic of the second step of the process, assists in the flotation of the hydrocarbon-coated particles" (Transcript, page 673, middle of page.)

Kirby's disclosure may be summarized as follows:

1. The process is applicable to a great variety of ores (Transcript, page 671, last paragraph).

2. States that it is impossible to give definite directions for attaining the best results with all ores because of their great chemical and physical differences (Transcript, page 672, lines 7-10).

3. Gives definite proportions and directions for one group of ores—the Rossland, British Columbia, ores (Transcript, page 672, line 17 *et seq.*).

4. Discloses the steps of the process and their order to the complete concentration of the ore (Transcript, page 672, lines 19-28).

5. Discloses a second stage or supplementary treatment for increasing the recovery of mineral by injection of air (Transcript, page 672, lines 28-33).

6. Gives the following directions regarding operations and ingredients:

a. *Heat.* States that the preference of the solution

for some of the mineral particles may be regulated by varying the temperature (Transcript page 673, lines 18-21).

b. Acid. States that the preference of water for other mineral particles may be regulated by adding some acid or other chemical (Transcript, page 673, lines 21-23).

c. Agitation. Recommends thorough agitation by rapid rotation of the agitator; indicates by arrows on his patent drawing reproduced above the currents caused by the agitation, and he represents by a curved dotted line on the drawing the characteristic vortex formed by such violent agitation; states that the mixture is so thoroughly agitated as to bring the solution (oil) into contact with all of the mineral particles (Transcript, page 672, lines 19-26 [quoted on page 178, *supra*], and page 676, lines 2-6). It is easily demonstrated, and is conceded by complainants' expert witnesses, that such agitation would inevitably beat air into the mixture (Ballantyne's discussion of Froment's similar apparatus, Transcript, page 238, X-Q. 87).

d. Quantity of Oil. Kirby states that he uses "a sufficient amount" of oil (Transcript, page 673, line 16), and with reference to a particular ore—the Rossland ore—says that he has obtained excellent results by using one-fourth to three-fourths as much oil by weight as ore (Transcript, page 673, lines 17-18). Experiment shows that such quantities of oil produce a froth or scum, and Kirby refers to the floating concentrate as a scum.

e. Character of Floating Concentrate. The Kirby process is made up of the precise steps that inevitably produce a froth or scum. Kirby refers to the floating concentrate as a scum (Transcript, page 675, line 7), and the concentrate could not be floated as he describes

in any other way than through the buoyancy of a froth of air bubbles, for the reason that he uses too little oil to cause flotation by the buoyancy of the oil, and furthermore, he uses a thin oil. Experiments in the practical application of the Kirby process result in the formation of a froth of floating concentrate.

Drs. Liebmann and Chandler, expert witnesses for Minerals Separation, Limited, state that the Kirby process is an oil-buoyancy process like the Elmore process (Transcript, page 282, next to last paragraph; page 333, fourth paragraph; page 380, line 14; and last line of page 380 to top of page 381), and that the Kirby process will not produce a froth (Transcript, page 281, lines 4 and 5; and page 380, fourth paragraph from bottom of page).

That the testimony of Drs. Liebmann and Chandler was incorrect is shown by their own testimony (Transcript, page 273, top of page, and page 368, near bottom of page, which testimony is quoted on pages 15 to 20, *supra*) that for the oil buoyancy process it is necessary to use three times as much oil as ore by weight, *i. e.*, from four to twelve times as much as Kirby used in the specific example described by him, in which he used only from one-fourth to three-fourths as much oil as ore by weight. The incorrectness of the testimony of these witnesses is further shown by Dr. Liebmann's statement that in the Elmore bulk-oil process the mixture "has to be agitated by slowly revolving agitation in such manner that the oil does not break into small globules" (Transcript, page 258, quoted in full on page 15, *supra*), while Kirby distinctly directs that the "materials be so thoroughly agitated together as to finely subdivide said solution [oil] into small globules and bring said globules into contact with substantially all of the pulverized mineral particles which will, by

preference, adhere to them." (Transcript, page 672, lines 22 to 26.)

Dr. Byrnes performed an experiment along the lines set forth in the Kirby patents. The following is his description of his experiment, appearing at pages 105-106 of the Transcript:

> "By using the Hyde slide machine, I have been able to carry out a process of separation corresponding to that of the Kirby patent 809,959. For this purpose I took 500 grams of the finely pulverized 'Black Rock' ore which is treated by defendant, and mixed it with from 'three to five times' its weight of water, that is, with sixteen hundred cubic centimeters, acidulated by the addition of 1 cubic centimeter of sulphuric acid, and with an amount of kerosene equal to one-fourth that of the ore, that is, 125 grams. The temperature of the water used was 35° C. On agitating this mixture for thirty seconds by rotation of the central shaft having four radial arms, I was able to so thoroughly oil the sulfid and aerate the oiled particles by the air entrained by the agitation, without any injection of streams of air to float the particles entangled in the tailings, as to produce a floating froth of concentrates nearly half an inch thick. I also roughly imitated the operation of blowing in air carried out by Kirby, by the use of a single tube pushed downward into the tailings at the bottom and moved about therein. By removing this first froth and repeating the operation of aerating by agitating, I was able to remove so much of the zinc sulfid from the ore as to leave the tailings comparatively light in color, that is, consisting largely of gangue." (Transcript, pages 105, 106.)

Kirby taught the art all that was necessary to know to practice oil flotation, and all that it is possible for anyone to teach today. Kirby's directions are sufficient to enable anyone skilled in the art to which the invention appertains to practise the invention.

Kirby gave the principle complete with the rule of action. There was nothing after him but for the engineer

to ascertain the definite proportions for any particular ore, *i. e.*, to find the oils that would be most economical in the particular localities where they would have to be used, having in mind the cost of the oil, the quantity that would be "a sufficient amount," freight charges, etc.

All that the patentees of the patent in suit did was to suggest certain more or less indefinite proportions of water, ore, oil and acid for the treatment of another ore found in another locality. Even had their directions been definite and exact, they simply as trained engineers exercised the expected skill of their particular calling. Even if they had attained greater economy in the amount of oil used, that would not have amounted to invention.

For convenience, we present the following comparison in parallel columns of the Kirby process and the process of the patent in suit:

Kirby.	Patent in Suit.
OBJECT.	OBJECT.
"The invention relates to the concentration of ores. It may be employed to separate the metallic minerals from the gangue, or to separate certain of the metallic minerals from others, or from others and the gangue." (Kirby patent, Transcript, page 671, second paragraph.)	"This invention relates to improvements in the concentration of ores, the object being to separate metalliferous matter, graphite, and the like from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for metalliferous matter over gangue." (Patent in suit, Transcript, page 475, second paragraph.)
"The operation of the process is dependent upon the fact that, because of differences in physical characteristics of the various constituents of mineral material, such constituents	

show preferences of adhesion between two commingled, but immiscible liquids." (Kirby patent, Transcript, page 671, third paragraph.)

APPLICABILITY OF PROCESS TO DIFFERENT ORES.

"It is believed that the process or some of the novel steps thereof may be employed with advantage in the treatment of all ores." (Kirby patent, Transcript, page 672, lines 6 and 7.)

DEFINITE DIRECTIONS FOR ALL ORES NOT POSSIBLE.

"It is obviously impossible, however, to give definite directions for attaining the best results with all ores, because of the great chemical and physical differences which they exhibit." (Kirby patent, Transcript, page 672, lines 7 to 10.)

DIRECTIONS FOR TREATING A PARTICULAR ORE.

Pulp.

". . . enough water to make with said pulverized ore a flowing pulp." (Kirby patent, Transcript, page 672, lines 20 and 21.)

APPLICABILITY OF PROCESS TO DIFFERENT ORES.

"The proportion of mineral which floats in the form of froth varies considerably with different ores and with different oily substances." (Patent in suit, Transcript, page 476, lines 15 to 17.)

DEFINITE DIRECTIONS FOR ALL ORES NOT POSSIBLE.

". . . in the concentration of any particular ore a simple preliminary test is necessary to determine which oily substance yields the proportion of froth or scum desired." (Patent in suit, Transcript, page 476, last four lines of first paragraph.)

DIRECTIONS FOR TREATING A PARTICULAR ORE.

Pulp.

". . . ore is finely powdered and mixed with water." (Patent in suit, Transcript, page 476, lines 21 to 23.)

Acid.

"The preference of the water for other mineral particles may be regulated by adding some acid or other chemical." (Kirby patent, Transcript, page 673, lines 21 to 23.)

Acid.

". . . the water in which the oiling is effected is preferably slightly acidified by adding, say, a fraction of 1 per cent. up to 1 per cent. of sulphuric acid or other mineral acid or acid salt." (Patent in suit, Transcript, pages 475-476, beginning at bottom of page 475.)

Oil.

"a sufficient amount" . . . "excellent results being obtained by using one-fourth to three-fourths as much, by weight, as ore." (Kirby patent, Transcript, page 673, lines 16 to 18.)

These amounts of oil are insufficient to cause flotation except in the form of a froth buoyed up by the contained air bubbles.

Oil.

". . . if the proportion of oily substance be considerably reduced—say to a fraction of 1 per cent. on the ore." (Patent in suit, Transcript, page 475, last paragraph.)

Heat.

"The preference of the solution for some of the mineral particles may be regulated by altering or varying the quantity of the solute substance and by varying the temperature at which the solutions is used." (Kirby patent, Transcript, pages 673, lines 18 to 21.)

Heat.

"The mixture is warmed, say, to 30° to 40° centigrade." (Patent in suit, Transcript, page 476, middle of page.)

Agitation.

"This shaft *a* is to be rotated rapidly, and the result is a thorough commingling of the various parts of the charge." (Kirby patent, Transcript, page 676, top of page.)

"First, in thoroughly agitating together (*a*) the pulverized ore or mineral material, (*b*) enough water to make with said pulverized ore a flowing pulp, and (*c*) a solution of bitumen in a thin distillable hydrocarbon liquid as kerosene, these materials to be so thoroughly agitated together as to finely subdivide said solution into small globules and bring said globules into contact with substantially all of the pulverized mineral particles which will, by preference, adhere to them.

"Second, in allowing the hydrocarbon-coated particles to float to the surface of the mass. . . ." (Kirby patent, Transcript, page 672.)

Claims 1, 2 and 3 of the Kirby patent refer to the agitation in the first and principal stage of the process as "violently agitattating." (Transcript, page 678.)

Agitation.

"Vigorous agitation." (Transcript, page 475, last paragraph.)

". . . briskly agitated in a cone-mixer or the like, as in the processes previously cited, for about two and one-half to ten minutes, until the oleic acid has been brought into efficient contact with all the mineral particles in the pulp."

RESULT OF PROCESS.

Kirby, after describing the thorough agitation above referred to, states that the next step consists "in allowing the hydrocarbon-coated particles to float to the surface of the mass." (Kirby patent, Transcript, page 672, paragraph beginning with the word "Second.") He refers to the concentrate as a "floating scum of hydrocarbon liquid, air bubbles, and concentrates." (Kirby patent, Transcript, page 675, lines 7-8.) As shown by the evidence hereinbefore referred to, the quantity of oil used by Kirby in the specific example described by him does not possess sufficient buoyancy and being thin has not the necessary viscosity, to float the concentrate except in the form of a froth deriving its buoyancy from the included air bubbles, and a literal application of Kirby's directions in practice does in fact produce a froth or scum consisting of air bubbles covered with concentrate.

SUPPLEMENTAL OPERATIONS.

Kirby knew that a large proportion of the mineral would rise and float immediately after the thor-

RESULT OF PROCESS.

"When agitation is stopped, a large proportion of the mineral present rises to the surface in the form of a froth or scum, . . ." (Patent in suit, Transcript, page 476, below middle of page.)

SUPPLEMENTAL OPERATIONS.

The patentees of the patent in suit state that "when agitation is stopped, a large proportion of

ough agitation described by him, for after describing such agitation as the first step of the process, he says: "Second, in allowing the hydrocarbon-coated particles to float to the surface of the mass,"* and then he goes on to suggest the step of "rendering this separation substantially complete by gently agitating the mass, and by injecting gas into the same, and preferably also discharging into the mass fine streams of the solution." (Kirby patent, Transcript, page 672.)

Kirby refers to the injection of air as "the second step of the process." (Kirby patent, Transcript, page 673, line 29.) He states that "Some of the hydrocarbon-coated particles will float to the surface without assistance; but a considerable quantity the mineral present rises to the surface in the form of a froth or scum" (patent in suit, Transcript, page 476, next to last paragraph), and later on they make the following statements:

"The metalliferous matter which did not form part of the froth (generally the larger particles) remains in admixture with the gangue in the pulp. To recover this, the pulp is distributed in a thin layer on a shaking-table, convex buddle, or the like, whereon the mineral is exposed to a free-air surface, which exposure may be increased by the application of air-blast or air-jets or the like and thereafter brought onto the edge or surface of liquid, whereby the metalliferous matter floats and is separated from the gangue, which sinks, as de-

*That Kirby knew that the violent agitation caused most of the mineral to float without the assistance of any subsequent operations is confirmed by the statements made in another patent for the apparatus used in the process of his patent 809,959. This apparatus patent (Transcript, page 687) No. 838,626, was granted December 18, 1906, upon an application filed December 17, 1903, a year and four months prior to any date which can be credited to the patentees of the patent in suit. In the apparatus patent Kirby after referring to *thoroughly mixing* (Transcript, page 688, line 9) the oil, ore and water says: "Most of the solution and the solution-coated mineral particles rise immediately to the surface, from which they may be skimmed; but considerable quantities of the solution-coated concentrates are enveloped by and entrapped in the sands which settle to the bottom of the tank." (Transcript, page 688). Kirby follows this statement with an explanation that it is for the purpose of recovering these entrapped particles that he provides the supplemental operations of gentle agitation with injection of air.

of such particles will not be sufficiently buoyant, and some of such particles and some globules of the mixture would be trapped in the sands," and that "in order to recover this less buoyant material . . . a gas, preferably air, is blown into the mass . . ." (Kirby patent, Transcript, page 673, below middle of page.)

scribed in the specification of our previous United States application Ser. No. 246,637, filed February 20, 1905."

"The proportion of mineral recovered in the froth and that recovered by table flotation may be considerably varied; but, generally speaking, the froth will separate the slime mineral while the larger particles are recovered by the latter method." (Patent in suit, Transcript, page 477, second and third paragraphs.)

. . . .

"An alternative method for the recovery of any sunk oiled metalliferous matter which may be deposited in the second and third spitzkasten is as follows: The products suspended in circuit liquor are removed from the spitzkasten and placed in a vessel in which they are submitted to an additional pressure of air or other gas of from, say, one to two atmospheres or over. On relief of such pressure the bubbles of air or other gas so generated throughout the mass at once sweep to the surface thereof all the metalliferous matter in the form of a froth which can be separated as before." (Patent in suit, Transcript, page 478, near top of page.)

Then follows a description of apparatus for the supplementary operations.

APPARATUS FOR PROCESS.

Kirby shows and describes apparatus for carrying out his process.

APPARATUS FOR PROCESS.

The patentees of the patent in suit show and describe apparatus which they recommend for their process.

Originality of Invention.

When the parties composing Minerals Separation, Limited, conceived the idea of attempting to secure a patent monopoly upon oil-gas concentration, they based their claim upon certain operations performed by Mr. A. Howard Higgins, a metallurgist in their employ, who, under certain instructions, was investigating the old Cattermole sinking granule process.

As stated by Mr. Sulman, one of the grantees of the patent in suit, Mr. Higgins was instructed in the spring of 1905 to ascertain the effect upon the Cattermole process of making changes in the different steps performed, and different substances used in that process (Transcript, page 130, folio 260). Messrs. Sulman and Picard in their letter of March 3, 1905, addressed to John Ballot (which letter is printed at pages 446 to 448 of the Transcript), comment upon Mr. Higgins' investigations, and make the following statement for Mr. Ballot's information:

> "We are in full agreement with the rest of Mr. Higgins' observations, and may summarize the work now being done at Aldermanbury Avenue as the determination of the following factors:
>
> "(1) Influence of acidity on *granulation;*
>
> "(2) Influence of temperature on *granulation;*

"(3) Influence of speed of Gabbett agitation on *granulation;*

"(4) Influence of ratio of ore to liquor on *granulation;*

"(5) Influence of metallic salts on *granulation;*

"(6) Influence of the size of particles and of the influence of slimes on *granulation;*

"(7) Influence of the amount of oil on *granulation.*" (Italics ours.) (Transcript, pages 446-447.)

Each of the seven instructions is confined to the effect of the matters mentioned upon *granulation.* The term "granulation" is used by all of the parties connected with Minerals Separation, Limited, and is used in the Cattermole patents as descriptive of the agglomerating or cementing together into granules which occurs in the Cattermole process. There is not even a contention on the part of the grantees of the patent in suit that Higgins' instructions concerned any subjects whatever other than an investigation of the Cattermole sinking granule process.

According to the testimony of Mr. Picard (Transcript, page 151), the object of the instructions given to Mr. Higgins was simply to systematize the investigation of the Cattermole process by definitely ascertaining the most advantageous quantities of the different substances and the most advantageous manner of adjusting the other factors involved in that process.

Mr. Higgins was asked (Transcript, page 177, Q. 73) what he did when he first tried his experiments with the small quantity of oil which Minerals Separation, Limited, and their expert witness, Dr. Chandler, claim is the foundation of the invention of the patent in suit, and he replied that he called in Mr. Ballot to see one of these experiments performed, wherein froth was produced, but that he could not say which experiment it was, as he may have tried further experiments before making

his oral report. He further stated (Transcript, page 178, Q. 75) that he could not state the interval of time which elapsed between the performance of his first experiment with a small quantity of oil and the calling of Mr. Ballot, as he may have made certain that the froth production was not accidental before calling him. Mr. Higgins testified (Transcript, page 178, questions 76-78) that at the time of his first experiments with a small quantity of oil he felt certain that he noticed that he had obtained a high recovery and had removed some of the froth to judge its value before calling in Messrs. Sulman, Picard and Ballot. Upon this subject Mr. Higgins further testified (Transcript, page 179, questions 91 and 92) that after he performed his experiments with a small quantity of oil he was sure that a process of concentration might be carried out by separating the froth so formed, and that Messrs. Sulman, Picard and Ballot agreed with him, Mr. Ballot being particularly enthusiastic. Mr. Picard testified (Transcript, page 155, Q. 80) that the invention was complete after that first operation. Even if the result obtained by Higgins had not been anticipated and had been a new invention, it would have been Higgins' invention, and not the invention of Messrs. Sulman, Picard and Ballot. Higgins, according to their testimony, had been instructed to perfect a means of causing the valuable minerals to sink. While carrying out his investigation of a process for causing the metalliferous mineral to sink he encountered the old flotation effect.

It appears from the testimony of Mr. Sulman (Transcript, page 133, Q. 40), Mr. Picard (Transcript, page 150, Q. 20), and Mr. Higgins (Transcript, page 178, Q. 75) that none of the grantees of the patent in suit were present when Mr. Higgins first performed the operation which has been made the subject-matter of

that patent. Mr. Picard testified (Transcript, pages 155, 156, Q. 81) to the effect that prior to seeing Higgins' operations he had no idea that such a result could be obtained and that the result was an entire revelation to him, as he had never for one moment anticipated in his mind as being likely to occur what in fact did occur. This laudation of Higgins' operations was doubtless designed to support the contention that Higgins had done something new, but such testimony must defeat its own object, because, even if it established that Higgins had done something new, it would deprive Mr. Picard of all participation in the invention. Obviously, Mr. Picard could not be considered a joint inventor if what Higgins did was altogether unanticipated by him, and a complete revelation to him.

Even if Higgins, Sulman, Picard and Ballot were surprised and elated to find that flotation could be effected with a very small amount of oil, this was not an invention, but merely an observation on the part of Higgins that the old oil flotation effect could be brought about with a smaller quantity of oil than had been anticipated by them. It is not invention to observe that an old process can be carried out more economically than the observer had previously known. And even this observation was the act of Higgins performed independently of the alleged instructions which had nothing whatever to do with flotation.

Mr. Ballot, in another suit, testified (Transcript, pages 165, 166, Qs. 105-111) that his name appeared upon certain British patents because he was chairman of Minerals Separation, Limited, and was specially directed by the directors of that company to have his name added as a matter of extra precaution for the company. Under the law of Great Britain, which differs in this respect from the law of the United States, parties not the in-

ventors can join with an inventor in receiving the grant of a patent upon an invention.

The Law Upon Originality of Invention.

The following is quoted from the opinion of Mr. Justice Bradley in *Atlantic Works* v. *Brady:*

> "Sufficient appears, however, notwithstanding the evidence adduced to the contrary, consisting mostly of the testimony of the complainant himself, to convince us that Brady derived his whole idea from the suggestions of General McAlester; and that the plans for the construction of The Essayons originated entirely with that officer.
>
> "Our conclusion is, that the patent sued on cannot be sustained, and that the decree of the Circuit Court must be reversed, and the cause remanded with instructions to dismiss the bill of complaint." (*Atlantic Works* v. *Brady,* 107 U. S., 192, 199, 27 L. Ed., 438, 442, 2 Sup. Ct. Rep., 225.)

The question of originality of invention was discussed as follows by Mr. Justice Clifford in *Union Paper Collar Co.* v. *Deusen:*

> "*Suffice it to say, that it is not pretended that the original patentee invented either the paper or the process, but the claim in argument is that he was the first person to conceive the idea that paper possessing the described qualities was desirable for the purpose of making such collars;* and that, inasmuch as he was not a paper manufacturer he had a right to employ trained skill to produce the desired product, and that he, under the circumstances, should be regarded as the actual inventor because he made known to the manufacturer that paper of such qualities would be useful, and because he employed the manufacturer to engage in the effort to produce the desired article; but the patentee communicated no information to the manufacturer as to the constituents or ingredients to be used, or as to the mode of operation by which they were to be compounded in order to produce the desired result.

"Where a person has discovered a new and useful principle in a machine, manufacture or composition of matter, he may employ other persons to assist in carrying out that principle, and if they, in the course of experiments arising from that employment, make discoveries ancillary to the plain and preconceived design of the employer, such suggested improvements are in general to be regarded as the property of the party who discovered the original principle, and they may be embodied in his patent as part of his invention.

"Doubt upon that subject cannot be entertained; *but persons employed, as much as employers, are entitled to their own independent inventions, and if the suggestions communicated constitute the whole substance of the improvement the rule is otherwise, and the patent, if granted to the employer, is invalid, because the real invention or discovery belongs to the person who made the suggestions. Agawam Co.* v. *Jordan,* 7 Wall., 602; 74 U. S., XIX, 181.

"Apply that rule to the present case and it is clear that the original patentee was not entitled to a patent either for the paper or the process, as he never made any invention or discovery upon the subject." (*Union Paper Collar Co.* v. *Van Deusen,* 90 U. S., 530-566; 23 L. Ed., pp. 128, 133; 23 Wall., 530.) (Italics ours.)

The following is taken from the opinion of Judge Nelson in *Pitts* v. *Hall:*

"Now, there is no doubt that a person, to be entitled to the character of an inventor, within the meaning of the act of congress, must himself have conceived the idea embodied in his improvement. It must be the product of his own mind and genius and not of another's. Thus, in this case, the arrangement patented must be the product of the mind and genius of Carey, and not of Bowers' or Fowler's. This is obvious to the most common apprehension. At the same time, it is equally true that, in order to invalidate a patent on the ground that the patentee did not conceive the idea embodied

in the improvement, it must appear that the suggestions, if any, made to him by others, would furnish all the information necessary to enable him to construct the improvement. In other words, the suggestions must have been sufficient to enable Carey, in this case, to construct a complete and perfect machine. If they simply aided him in arriving at the useful result, but fell short of suggesting an arrangement that would constitute a complete machine, and if, after all the suggestions, there was something left for him to devise and work out by his own skill or ingenuity, in order to complete the arrangement, then he is, in contemplation of law, to be regarded as the first and original discoverer. On the other hand, the converse of the proposition is equally true. If the suggestions or communications of another go to make up a complete and perfect machine, embodying all that is embraced in the patent subsequently issued to the party to whom the suggestions were made, the patent is invalid, because the real discovery belongs to another." *Pitts* v. *Hall,* Fed. Case No. 11,192 [2 Blatchf., 229; 1 Fish Pat. Rep., 441].

The following discussion of the question of originality of invention is taken from the opinion of Mr. Justice Clifford in *Agawam* v. *Jordan:*

"Persons employed, as much as employers, are entitled to their own independent inventions, but where the employer has conceived the plan of an invention and is engaged in experiments to perfect it, no suggestions from an *employé,* not amounting to a new method or arrangement, which, in itself is a complete invention, is sufficient to deprive the employer of the exclusive property in the perfected improvement. But where the suggestions go to make up a complete and perfect machine, embracing the substance of all that is embodied in the patent subsequently issued to the party to whom the suggestions were made, the patent is invalid, because the real invention or discovery belonged to another." *The Agawam Woolen Co.* v. *Eben D. Jordan,* 74 U. S., 583; 19 L. Ed., 177; 7 Wall., 602.

Infringement.

We submit that the most that can possibly be claimed for the patent in suit is that it contains a mathematical recitation of proportions and ingredients adapted for the application of an old process to a particular ore without adding anything to the prior art, which disclosed the principle, the rule of action, substantially the same proportions, and identically the same ingredients and operations.

The invalidity of the patent in suit, and the absolute lack of novelty in the process therein set forth is demonstrated by the fact that complainants' attempt to prove infringement has resulted simply in showing that defendant has operated in strict accordance with the prior art. The efforts of Dr. Chandler, expert witness for Minerals Separation, Limited, to show that defendant's operations have been in accordance with the mathematically stated proportions set forth in the patent in suit were based upon guess and assumption; and necessarily so, for the reason that defendant did not utilize any mathematical statement of proportions of ingredients, but simply followed the principles and rule of action set forth in the prior art. Following is a brief analysis of the testimony regarding the charge of infringement.

Edward H. Nutter, complainants' chief engineer, testified (Transcript, page 40, folios 77 *et seq.*, beginning at bottom of page 40) that in the summer of 1911 he visited the concentration plant at Basin, Montana, where Mr. Hyde was operating upon the ore of the Butte & Superior Copper Company, this being the act upon which the charge of infringement is based.

Mr. Nutter stated that two days later he went to Basin, arriving there between 9 and 10 o'clock in the evening;

that he observed what he could of the flotation plant from the outside by looking through a window and cracks in the walls for an hour or more, and then entered the plant. The shift foreman, he says, objected to his presence, but he disregarded the objection, and says that he saw a flotation plant, of which he made a sketch, now in evidence as "Complainants' Exhibit Nutter Drawing Defendant's Apparatus." (Transcript, after page 556.) While in the building Nutter placed his hand in one of the froth separating boxes, and "noted the feel of the concentrate and of the liquor in the frothing box," and also "scooped a sample of the froth concentrate" in his hand, transferring the same later to a bottle. It is upon an examination of the contents of this bottle, and various inferences and guesses based upon such examination, that the charge of infringement rests.

Defendant's Operations at Basin.

In order to place before the court precisely what was done by defendant in the plant in Basin, Montana, defendant testified on his own behalf, and also introduced the testimony of Mr. Jesse C. Gibson, one of the foremen of the Basin plant.

Mr. Hyde made a drawing of the Basin apparatus, "Defendant's Exhibit Hyde Sketch of Experimental Machine." (Reproduced preceding page 573 of the Transcript.)

Mr. Hyde testified (Transcript, page 82, folio 161) that he supervised the installation of the apparatus at Basin, Montana; that it was first operated in August, 1911; and that it was continued in operation intermittently for one or two months, and then destroyed, as the Basin Reduction Company needed the space. Mr. Hyde's description of the apparatus and process oper-

ated by him at Basin is best given in his own words. The sketch which he refers to is reproduced preceding page 573 of the Transcript. Mr. Hyde's description of the Basin operations appears at page 82, folios 161 *et seq.*, of the Transcript.

Mr. Jesse E. Gibson was produced as a witness on behalf of defendant. He testified that he had had experience as a millman and operated the flotation plant at Basin, Montana, under Mr. Hyde's directions, from the latter part of July, 1911, until February 7, 1912. (His testimony regarding the amounts of oil and acid used by him, and his knowledge of the flotation process, appears at pages 74 to 76 of the Transcript.)

Mr. Gibson testified that the vanner concentrates being operated upon at the time of Mr. Nutter's night invasion of the Basin plant were richer than the ordinary feed of the flotation plant, running from 10 to 20 per cent. richer. Mr. Gibson also testified that at the time of Mr. Nutter's visit the vanner concentrate was of about the condition of mud, and was fed into the flotation machine by buckets with the addition of water; that on account of the irregular feed, due to these conditions, it was impossible to adjust the machine to produce good results, there being too much oil added part of the time, and too little at other times. Mr. Gibson further stated that he was instructed in the use of the Basin apparatus by being shown the machine in operation and by being shown the effect produced by the use of too much and too little oil and acid; that a large amount of water flowed with the concentrate from the rougher; and that no water flowed away with the concentrate from the cleaner, and he explained the arrangement of valves, etc., by which the level of the liquid was adjusted to produce this result.

The operations at the Basin plant were conducted without weighing or measuring the oil or acid used, for the simple reason that it would be impossible to conduct the process in that manner, as the variations in the dilution of the material flowing through the plant and variations in the rate of flow naturally would render any procedure of that kind impracticable. Mr. Hyde and Mr. Gibson proceeded simply by adding enough oil and acid to produce the result desired.

Both Mr. Hyde and Mr. Gibson testified that they regulated the amount of oil so as to obtain the best results (Transcript, pages 84 and 75). Gibson stated that he did not know what amount of oil he used relative to the weight of the ore. From the experiments performed by Mr. Hyde and Dr. Byrnes, hereinbefore discussed, it is apparent that as effective concentration can be accomplished with more than 1 per cent. of oil as with less than that amount. With any amount of oil the process will fail if all of the other conditions are not properly adjusted, such as temperature, degree of violence and duration of agitation, use or non-use of acid, amount of acid, if any, used, dilution of pulp, etc. When Mr. Hyde and Mr. Gibson say that they used the amount of oil that would give the best result, they, of course, meant the smallest amount of oil that could be used without destroying the efficiency of the concentration, and the other conditions were adjusted for the use of that minimum amount. We do not contend that with the other conditions, such as temperature, degree and duration of agitation, acid, dilution of pulp, etc., adjusted for the minimum amount of oil equally good results can be obtained with a larger amount of oil. The experiments made by Dr. Byrnes and Mr. Hyde show differences in the other conditions when the amount of oil is changed. We do contend, however, that with any amount of oil,

small or large, the same results can be obtained by adjusting the other conditions to the amount of oil. With a change in the amount of oil, it is necessary to change other conditions. For instance, Mr. Sulman, one of the grantees of the patent in suit, testified as follows:

> "The first requisite of any oil concentration process is to obtain efficient contact between the oil and the mineral and suitable methods must be employed to effect this. Where the oil is in large relative quantity to the mineral violent agitation is unnecessary and may be very harmful. With decreasing proportions of oil more vigorous agitation or mixing is necessary to ensure such efficient contact of oil with the mineral particles. The agitation may therefore be said to be roughly proportioned to the work to be done in bringing about contact between large or small quantities of oil in regard to the mineral." (Transcript, page 129.)

On direct examination Mr. Hyde simply stated that he regulated the amount of oil according to the result produced; he did not testify regarding the absolute amount of oil relative to ore by weight. On cross-examination Mr. Hyde was asked regarding the amount of acid used at Basin (Transcript, page 90, X-Qs. 88-97), but it is significant that counsel for Minerals Separation, Limited, did not ask him regarding the amount of oil. The obvious inference is that counsel was afraid that he was using more than 1 per cent., and would so testify, and such a fear would have been justifiable by reason of the identity in appearance and effectiveness between froths produced with more and less than 1 per cent. in the experiments regarding which Mr. Hyde and Dr. Byrnes testified. Dr. Byrnes, furthermore, visited the mine and mill of the Butte & Superior Copper Company (Transcript, pages 115-118), and with more than seven times the amount of oil usually used obtained heavy froths and clean tailings, as good a result as he

saw produced at any time he was at the mill. Upon this point Dr. Byrnes testified as follows:

> "On another day, the 'rougher' was entirely emptied, both agitators and flotation-boxes. Operations were then resumed, the pulp entering the first agitator at a temperature of about 3° above freezing, before the steam was admitted. The pulp was then heated until its temperature in the first flotation-box was 30° C., and about the same in the other two. For the purpose of experiment, I had the iron vessel supplying 'red oil' to the first agitator emptied before beginning this run, and supplied it with cotton-seed oil, not heated. I then ran this oil into the agitator at about three times the rate of feed which was customary with the 'red oil,' obtaining good froths. The tailings were also quite good, though containing some mineral. I then opened the valve in the oil-discharge pipe to its full capacity, allowing about seven times the normal feed of oil to flow, also separately adding to the agitator a few per cent., proportionate to the cotton-seed oil, of the 'red oil,' warmed to make it liquid. I then obtained very good heavy froths and very clean tailings, as good, I think, as I saw produced at any time when I was at the mill. It is thus apparent that different oils can be used, in widely different proportions, as I also found in my tests with the Hyde slide apparatus." (Transcript, page 118.)

Dr. Chandler's Unwarranted Assumptions and Theories as to Infringement.

Dr. Chandler states that he found by analysis that the oil contained in the concentrates taken from the Basin apparatus by Mr. Nutter amounted to 0.36 per cent. of the concentrate by weight (Transcript, page 55, folio 108). He then assumed (Transcript, page 60) that this concentrate represented one-third of the original ore. No warrant is found in the record for the assumption other than the fact that the Butte and Superior ore contains

about 30 per cent. of blende. But it was not ore that was being treated at the time Mr. Nutter took the sample of froth. At that time vanner concentrates were being treated (Gibson's testimony, Transcript, page 75, bottom of page). There is absolutely nothing in the record to show the percentage of concentrates to material treated at the time of Nutter's visit to Basin.

Dr. Chandler then, in an alleged effort to duplicate the operation which Nutter had seen at Basin, performed the experiments he has described, using 400 grams of ore, and assumed that by taking 0.36 per cent. of 133 grams (one-third of the 400 grams used by him) (Transcript, page 60) he would be reproducing the Basin operations. Inasmuch, however, as the material treated at Basin at the time of Nutter's visit was of unknown and variable composition, the assumption is a pure guess. Not content with this excursion into the field of speculation, Dr. Chandler made the further assumption that he should add one-third as much more oil for the imagined loss on the tailings (Transcript, page 60, folio 117). Having arranged these premises to his satisfaction and added up the figures which he selected for that purpose, he finds that the result is an amount of oil which, he says "is well within the quantity specified in the claims of the patent" (Transcript, page 60). Doubtless he or anyone else could select an infinite number of other combinations of figures that would fall within the 1 per cent. named in the patent in suit.

Dr. Chandler's own experiments do not support his assumption that the concentrates represent one-third of the material treated, even in the case of ore or regular flotation feed, to say nothing of the vanner concentrates of unknown composition being treated at the time Nutter took the specimen of froth at Basin. Out of 400 grams of material treated he obtained in his second experiment

.79 grams of concentrates; in his third experiment 121 grams of concentrates; in his fourth experiment 152 grams of concentrates; in his fifth experiment 68 grams of concentrates; and in his sixth experiment 42 grams of connectrates (Transcript, pages 58 and 59). In Dr. Chandler's experiments, therefore, as shown by his own figures, the concentrates varied in weight from 10 per cent. to 38 per cent. of the weight of the material treated.

Likewise Dr. Chandler's experiments failed to confirm his assumption that there would be a loss of oleic acid on the tailings equal to one-third of the oleic acid on the concentrates. Referring to Dr. Chandler's tabulated report (Transcript, pages 58, 59) we find the amount of oleic acid on the concentrates and tailings as follows:

	Oleic Acid on Concentrates.	*Oleic Acid on Tailings.*	*Percentage on Tailings.*
Exp. 1	.2635 grams	.1715 grams	65%
" 2	.508 "	.084 "	17%
" 3	.486 "	.092 "	19%
" 4	.537 "	.103 "	19%
" 5	.2735 "	.079 "	29%
" 6	.154 "	.067 "	44%

The figures in the first two columns above are taken from Dr. Chandler's tabulated statement of his experiments appearing on pages58 and 59 of the Transcript. The percentages in the last column were obtained by dividing the figures in the second column by those in the first. In Experiment 1 the weight of the oleic acid on the tailings was 65 per cent. of the weight of the oleic acid on the concentrates, in Experiment 2, 17 per cent., and so on through the six experiments.

From the foregoing figures taken from Dr. Chandler's testimony, and the percentages calculated therefrom, we find that Dr. Chandler's experiments show a variation

in the percentage of oil on the tailings to the oil on concentrates ranging from 17 per cent. to 65 per c From the fact that when operating on one kind of m rial the percentage of oil on tailings to that on con trates varies from 17 per cent. to 65 per cent., Dr. Ch dler assumes that when operating on an altogether dif ent material of unknown and varying composition vanner concentrates treated when Nutter took the s ple) the percentage of oil on tailings to oil on con trates will be 33 per cent. Upon this *non-sequitur* charge of infringement rests.

Dr. Chandler also gives some figures regarding amount of oil found on what he terms "middlings" tained in his experiments. After removing the froth added water to the froth, and refloated it. It is the terial lost in refloating the froth that he calls middli Mr. Nutter did not see or obtain any such middling Basin, and it is not apparent from his testimony whet the froth that he took away was part of the first fr or of the froth resulting from the retreatment. In operations at Basin the material lost in the retreatm or formation of the second froth was returned the "rougher," *i. e.*, the part of the appara where the first froth was recovered (Transcript, page top of page). These so-called middlings were never arately recovered, and there was no possible way of certaining at any given time how much, if any, of s middlings were being formed and returned to rougher. Inasmuch as it is not known whether the p at which Nutter took the froth specimen was before after the point at which middlings would be separa and inasmuch as it is not known whether any middling all were being formed at the time of his visit, no poss light can be thrown on the case by a discussion of Chandler's statistics on the subject of middlings.

Dr. Chandler's testimony does not even suggest any probability of infringement by Mr. Hyde's operations at Basin. He has simply performed some experiments in which he obtained a froth by the use of less than 1 per cent. of oil. He has utterly failed to show the slightest connection between these experiments and Mr. Hyde's work at Basin.

Law on Proof of Infringement.

Infringement is a tort, and the burden of proving it rests upon the complainant:

Seymour v. *Osborne,* 11 Wall., 516; 20 L. Ed., 33.
Mitchell v. *Tilghman,* 19 Wall., 287; 2 L. Ed. 125;
Bates v. *Coe,* 98 U. S., 31; 25 L. Ed., 68.
Price v. *Kelly,* 154 U. S., 669 Appx.; 14 Sup. Ct. Rep., 1208; 26 L. Ed., 634.

To the same effect is the decision of the Circuit Court of Appeals for the Third Circuit delivered by Judge Buffington in *Fried. Krupp Aktien-Gesellschaft* v. *Midvale Steel Co.,* 191 F. R., 588, 591, from which we quote the following:

> "We deem it proper, however, to say for the guidance of patent practitioners in this circuit that it should be borne in mind that infringement is not only a question of fact, but is a tort or wrong, the burden of establishing which, as in all torts, clearly rests on those who charge such wrong. The absence of actual fact proof is not met by the presence of expert speculations no matter how voluminous. In this particular case the whole superstructure of the vast mass of expert testimony, in the last analysis, depends on what the Midvale Company did when making armor-plate as testified to by Leonard and Ross. They were the only witnesses who saw and testified thereto, and, when the judge below became convinced that these two witnesses did not prove facts which showed infringe-

> ment, he rested, and could rightfully rest, his decision on that ground. That such a course has commended itself to the master minds of the law is illustrated by what was said of the late Lord Chancellor Halsbury, that 'he had exercised a remarkable influence over the judicial temper of the House of Lords by always acting on the maxim that you must first settle what are the real facts of the case before you begin to apply the law."

The very gist of the alleged invention claimed in the patent in suit, and of the charge of infringement in the case at bar, is the use of less than 1 per cent. of oil in the flotation process. Some of the claims define the amount as a fraction of 1 per cent., and other claims define the quantity as a minute amount. The expression "a minute amount" can only be interpreted as meaning less than 1 per cent. when read in connection with the specification of the patent. This record contains not a vestige or suggestion of proof that Respondent used less than 1 per cent. of oil in his operations. The only testimony upon this point is that of Respondent himself, and that of Mr. Gibson, his foreman. Both of them testify, as hereinbefore stated (*supra*, pp. 203, 204), that they were guided in adjusting the amount of oil solely by the result obtained, and the evidence herein conclusively shows that the result referred to, viz., the production of a concentrate froth, can be produced as efficiently with amounts of oil vastly in excess of 1 per cent. as with quantities less than 1 per cent. Under these circumstances there is an absolute failure of proof of infringement.

Grounds Upon Which Petitioner Seeks a Reversal of the Decision of the Court of Appeals.

In their petition for a writ of certiorari, petitioners set forth five reasons wherefor they think the writ should be granted, these reasons being as follows (petition for writ of certiorari, pages 3 and 4):

1. Petitioner states that the decision of the United States Circuit Court of Appeals in the case at bar is at variance with certain judgments rendered by the Privy Council of the British Empire and by the British House of Lords respecting the same invention.

2. Petitioner alleges that the decision of the Court of Appeals in the case at bar is in conflict with the decision of this court upon the weight to be given the alleged use of the patented process and the alleged non-use of earlier processes.

3. Petitioner alleges that there is a conflict of adjudication among the different Circuits on the effect as an anticipation of an invention patented subsequent to the origin of the invention in issue but upon an application for patent filed prior thereto.

4. Petitioner alleges that the rights of British corporations are involved and that questions of international importance arise.

5. Petitioner alleges that the questions involved are of gravity and importance.

We shall briefly discuss these five topics, relying largely, however, upon references to the foregoing part of this brief where several of the matters referred to have been fully discussed.

1. Alleged Variance Between the Court of Appeals for the Ninth Circuit and the British Courts.

Upon page 4 of the petition for a writ of certiorari petitioners state that the decisions of the Britsh courts "are in direct conflict with the decision of the Circuit Court of Appeals of the Ninth Circuit written by Judge Gilbert and concurred in by Judges Ross and Dietrich." To this proposition our answer is an unqualified denial, and we submit that our discussion of this topic upon pages 71 to 91, *supra,* demonstrates beyond the possibility of doubt that there is not, and from the nature of the case could not be, any variance as alleged by petitioners.

2. Alleged Conflict Between Court of Appeals and this Court on the Question of the Weight to be Given to Use of An Alleged Invention.

We have shown that the introduction of flotation into practical use does not date from the alleged invention of the patent in suit; that flotation was never used in this country until many years after the grant of the patent in suit; that the patent in suit contains no information not disclosed in the prior art; that neither the patent in suit nor any other patent or publication in existence contains the solution of the many problems of flotation concentration; that, as admitted by petitioner's witness, Nutter, flotation concentration is still an experimental art and each ore presents a separate problem that must be separately solved; that, as shown by this record, flotation was not widely used even at the date of the trial of this case; and that the record does not show that respondent has infringed the patent in suit or that he has

derived the slightest assistance from anything described in the patent in suit and not described with equal or greater clearness in the prior art patents and literature.

We have discussed the question of use of the alleged invention on pages 54 to 71, *supra*, and the question of infringement on pages 200 to 210. Upon the subject of alleged use of the invention the Court of Appeals accurately describes the situation in the following passage quoted from the court's opinion in this case:

> "The decision of the court below appears to have been largely influenced by the consideration that the appellees' patent had gone into extensive and successful use. The fact that a patented device or process has gone into extensive and successful use is often of value in determining the question of invention and patentability. It is referred to for the purpose of turning the scales in cases of grave doubt. It is of no value whatever where the question of invention or patentability is free from doubt, and in any case its value depends largely upon the causes which produced it. It is often due to business ability in manufacturing, exploiting and advertising, and to the fact that prior conditions have not stimulated development. The appellees' process, originally patented in Great Britain, has been installed in Australia, Sweden, Finland, Chile and Wales, and it is in the process of installation in Cuba. It is not improbable that in those countries the prior art may have been substantially unknown, and it is possible that the appellees' success there is referable to the fact alleged in the bill, 'that the complainants have been to great trouble and expense in the introduction into use of the process, and have invested large sums of money in its introduction into commercial use in different parts of the world, and in the effort to introduce it into commercial use in the United States.' It is in evidence that in making the process known to the public in the United States, the appellees have expended $60,187. Notwithstanding these efforts and expenditures, their process has not yet been installed in the United

States. In *Olin* v. *Timken,* 155 U. S. 141, 155, it was said: 'While the patented article may have been popular and met with large sales, that fact is not important when the invention is without patentable novelty.' In *McClain* v. *Ortmayer,* 141 U. S. 419-428, the court said 'That the extent to which a patented device has gone into use is an unsafe criterion even of its actual utility, is evident from the fact that the general introduction of manufactured articles is as often effected by extensive and advantageous advertising, activity in putting the goods upon the market, and large commissions to dealers, as by the intrinsic merit of the articles themselves.' "

(Transcript, pages 721-722.)

3. Effect of Date of Application for Patent as Proof of Prior Invention.

Petitioner alleges that there is a conflict of adjudication in different Circuits regarding the effect of alleged anticipation by an invention patented subsequent to the origin of the alleged invention in issue, but on an application for patent filed prior to the origin of the alleged invention in issue.

No conflict exists. Petitioner has quoted statements made by the courts upon the defenses of prior patenting and prior publication and has represented that these statements were made with reference to the altogether distinct defense that the patentee is not the original and first inventor. In this connection we present the following discussion of the various defenses that may be pleaded in contesting the validity of patents for inventions.

The Statutory Provisions.

The conditions precedent to the grant of letters patent are set forth in Section 4886 of the Revised Statutes:

> "Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."
>
> (Revised Statutes, Section 4886.)

Several defenses which may be pleaded under the general issue are set forth in Section 4920 of the Revised Statutes:

> "Section 4920. In any action for infringement the defendant may plead the general issue, and, having given notice in writing to the plaintiff or his attorney thirty days before, may prove on trial any one or more of the following special matters:
>
> "First. That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,
>
> "Second. That he had surreptitiously or unjustly obtained the patent for that which was in fact invented by another, who was using reasonable diligence in adapting and perfecting the same; or,
>
> "Third. That it has been patented or described in some printed publication prior to his supposed invention or discovery thereof, or more than two

years prior to his application for patent therefor; or,

"Fourth. That he was not the original and first inventor or discoverer of any material and substantial part of the thing patented; or,

"Fifth. That it had been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public. . . ."

(Revised Statutes, Section 4920.)

Bates vs. Coe.

Petitioner contends (petition for writ of certiorari, top of page 23) that the Court of Appeals did not in the case at bar apply the law as stated in *Bates* v. *Coe* in treating the Kirby and Schwarz processes as anticipatory of the patent in suit.

In the case of *Bates* v. *Coe* (98 U. S., 31; 8 Otto, 31-50; 25 L. Ed., 68), Mr. Justice Clifford, delivering the opinion of this Court, enumerates three of the defenses provided in Section 4920, and discusses the subject as follows:

> "Defenses of the kind which it is important to notice in the present case are the following: (1) That the patentee is not the original and first inventor of any material and substantial part of the thing patented. (2) That the improvement had been patented or described in some printed publication prior to the supposed invention. (3) That it had been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public.
>
> . . . . . .
>
> "Each of these defenses, it will be seen, goes to the entire invention and not to separate parts of the thing patented; and the provision is that if any one or more of the special matters alleged shall be found for the defending party, the judgment or decree shall

be rendered in his favor, with costs. R. S., 2nd Ed., Sec. 4920.

"*Evidence to sustain the second defense* is sufficient if the patent introduced for the purpose, whether foreign or domestic, was duly issued or the complete description of the invention was published in some printed publication prior to the patented invention in suit, and the patent offered in evidence or the printed publication will be held to be prior, if it is of prior date to the patent in suit, unless the patent in suit is accompanied by the application for the same, or unless the complainant introduces parol proof to show that his invention was actually made prior to the date of the patent or prior to the time the application was filed.

"Neither the defendant in an action at law nor a respondent in an equity suit can be permitted to prove that the invention described in the prior patent, or the invention described in the printed publication, was made prior to the date of such patent or printed publication, for the reason that the patent or publication can only have the effect as evidence that is given to the same by the Act of Congress. Unlike that, the presumption in respect to the invention described in the patent in suit, if it is accompanied by the application for the same, is that it was made at the time the application was filed; and the complainant or plaintiff may, if he can, introduce proof to show that it was made at a much earlier date." (98 U. S., 31; 8 Otto, 31, 50; L. Ed., 25, page 69.) (Italics ours.)

Now it is absolutely clear that Mr. Justice Clifford was referring to the defenses of prior patenting and prior publication in his statement that a defendant might not prove "that the invention described in the prior patent, or the invention described in the printed publication, was made prior to the date of such patent or printed publication." In making this statement Mr. Justice Clifford referred to this particular defense. He directs the whole discussion to "Evidence to sustain the second defense," the second defense enumerated by him is "(2) That the

improvement had been patented or described in some printed publication prior to the supposed invention." Mr. Justice Clifford's remarks had no reference whatever to the first and third of the defenses enumerated by him, namely, that the patentee is not the original and first inventor and that the invention had been in public use or on sale. He expressly confined his discussion above quoted to the second defense—prior patenting and prior publication. If anything other than the clear and concise language quoted were needed it would only be necessary to turn to a later passage in Mr. Justice Clifford's opinion where he expressly excludes from consideration the defense that the patentee was not the original and first inventor. Following are Mr. Justice Clifford's remarks upon this point:

> "Two assignments of error, to wit: the second and fifth, must not be passed over without comment. They are to the effect that the court erred in holding that the patentee was the original and first inventor of the respective improvements specified in the second and fourth claims of the patent.
>
> "Two objections to those assignments of error exist, each of which is sufficient to show that they cannot be allowed: (1) That there is no such defense set up, either in the answer or amended answer. Nothing can be assigned for error which contradicts the record, nor can an appellant be allowed to assign for error the ruling of the court in respect to any defense not set up in his plea or answer. Appellate Courts cannot amend the pleadings, nor can they allow that to be accomplished by an assignment of an error. (2) Neither of those defenses is pleaded as required by the Act of Congress, as each is pleaded to a separate claim of the patent, and not to the invention which is embodied in the specification." (98 U. S., 31; 8 Otto, 31, 50; L. Ed., 25, pp. 73-74.)

Decision of Circuit Court of Appeals in Harmony With Decision in Bates vs. Coe.

Petitioners say, as above stated, in their petition for a writ of certiorari that there is conflict between the decision of this court in *Bates* v. *Coe* and the decision of the Circuit Court of Appeals for the Ninth Circuit. (Petition for writ of certiorari, top of page 23.) The contrary is the case, as shown by the facts set forth below.

Dates of Invention of Process of Patent in Suit and of Anticipating Processes.

The patent in suit, No. 835,120, was applied for May 29, 1905, and granted November 6, 1906. (Transcript, page 475.) The grantees of the patent in suit have a British patent for the same invention, No. 7803 of 1905 (Transcript, page 533), the application for which was filed April 12, 1905. The grantees of the patent in suit are therefore entitled, as provided in Section 4887 of the Revised Statutes, to the same rights that would have been obtained by filing their United States application on April 12, 1905. Following is the pertinent clause of Section 4887:

> "An application for patent for an invention or discovery or for a design filed in this country by any person who has previously regularly filed an application for a patent for the same invention, discovery, or design in a foreign country which, by treaty, convention, or law, affords similar privilege to citizens of the United States shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, discovery, or design was first filed in such foreign coun-

try, provided the application in this country is filed within twelve months in cases within the provisions of section forty-eight hundred and eighty-six of the Revised Statutes, and within four months in cases of designs, from the earliest date on which any such foreign application was filed."

Defendant pleaded in his answer that the grantees of the patent in suit were not the original, first or true inventors of the alleged invention set forth therein (Transcript, page 15), and that every material and substantial part of said supposed invention or discovery had been invented by certain other parties before the alleged invention thereof by the grantees of the patent in suit (Transcript, pages 16 and 17). Among the parties named in connection with this defense were Alfred Schwarz and Edmund B. Kirby.

Defendant offered in evidence the Kirby and Schwarz patents and duly certified copies of the applications therefor as filed in the United States Patent Office. (Transcript, page 120.)

Kirby patent No. 809,959 was applied for December 14, 1903, and granted January 16, 1906. (Transcript, page 671.)

Kirby patent No. 838,626 was applied for December 17, 1903, and granted December 18, 1906. (Transcript, page 687.)

Schwarz patent No. 807,503 was applied for May 27, 1904, and granted December 19, 1905. (Transcript, page 667.)

It was stipulated by and between the parties (as appears at page 395 of the Transcript) that printed Patent Office copies of the specifications and drawings of United States patents should have the same force and effect as original letters patent as to the facts set forth in said printed copies, including the dates of filing of the appli-

cations for said letters patent and the issuance thereof. In view of the fact that there was no controversy as to the fact that the Kirby application was filed upon the date above set forth, in view of the stipulation referred to, and in view of the fact that in their arguments before the District Court and the Circuit Court of Appeals counsel for petitioner distinctly stated that they would raise no question regarding the effect of an application filed before the application for the patent in suit but not resulting in a patent until after the filing of the application for the patent in suit, we abbreviated the record by omitting the file-wrapper and contents of the Kirby patent from the Transcript sent up by the District Court to the Court of Appeals.

Defendant did not plead the Kirby and Schwarz patents as prior patents or as prior publications. They are not prior patents inasmuch as they were not granted and did not come into existence as patents until after April 12, 1905, the effective date to which the grantees of the patent in suit are entitled.

Upon the issue that the grantees of the patent in suit were not the original and first inventors it was competent for defendant to prove that the supposed invention had been made previously by Kirby and Schwarz, and defendant proved this fact by proving that Kirby and Schwarz had filed applications for patents upon the invention long before April 12, 1905. There is nothing in *Bates* v. *Coe* that in any way restricts the kind of evidence that may be adduced to prove the date of an anticipatory invention when a defendant pleads that the grantee of the patent in suit was not the original and first inventor. The reasoning in *Bates* v. *Coe* is limited to the defense of prior patenting and prior publication, and Mr. Justice Clifford expressly excluded from con-

sideration the defense of prior invention because that defense had not been properly pleaded.

There is no conflict or suggestion of conflict between the decisions of the Circuit Court of Appeals for the Ninth Circuit and that of this court in *Bates* v. *Coe.*

Alleged Conflict Between Different Circuit Courts of Appeals.

Petitioners contend that there is disagreement between the Circuit Courts of Appeal of the different Circuits on the question referred to above as to the effect of the filing of an application for patent in which an invention is described that is patented by another upon an application filed at a later date. Below we discuss each of the cases cited by petitioners in their petition for a writ of certiorari (pages 23 and 31 to 35) as showing such diversity of decision, and we find not only that there is no disagreement, but that the courts which are said to disagree did not even have the same issue to decide.

Vacuum Engineering Co. vs. Dunn.

Petitioner contends that the decision of the Circuit Court of Appeals for the Ninth Circuit in the case at bar is in conflict with the decision of the Circuit Court of Appeals for the Second Circuit in *Vacuum Engineering Co.* v. *Dunn* (209 F. R., 219). In that case the patent in suit was granted to Locke and Dunn on July 21, 1908, the application having been filed March 9, 1906. The defense cited a patent granted to one Schiodt on May 21, 1907, upon an application filed May 3, 1905. The defendant could not dispute the validity of the patent because he had assigned the patent to the complainant, as stated by

the court, and, as further stated by the court, the defense was directed to an effort to show that the claims were narrow in scope. Inasmuch as the defendant was estopped from denying the validity of the patent in suit, no issue could by any possibility have been raised as to whether the grantee of the patent in suit was the original and first inventor. The defense was restricted to an effort to limit or narrow the construction to be placed upon the claims by reason of the prior art.

The Court of Appeals agreed with the lower court in holding that the Schiodt patent could not be considered as part of the prior art. The court based this ruling upon the fact that the application for the Schiodt patent was a confidential document in the files of the Patent Office at the time Locke and Dunn filed their patent application. The court held, furthermore, that even if the Schiodt patent were in the prior art they concurred with the conclusion of the lower court that it did not affect the claims of the patent in suit.

The court's decision in *Vacuum Engineering Company* v. *Dunn* did not involve the construction of any statutory defense or of any statutory requirement of any kind. The question before the court was simply that of construing the terms of the claims of the Locke and Dunn patent. That the court upon the question of construing claims did not think it proper to give weight to the application for the Schiodt patent has no bearing upon the weight to be given a patent application when offered in evidence under the properly pleaded statutory defense that the grantee of the patent in suit is not the original and first inventor. If the court in the Vacuum Engineering case had used the Schiodt application for the purpose of so restricting the Locke and Dunn claims as to relieve the defendant of the charge of infringe-

ment its action would have been virtually the same as permitting the defendant to do what he was estopped from doing, namely, contesting the validity of the patent in suit. To restrict claims in view of some anticipatory matter is simply to declare that upon a broad interpretation the claims are invalid and that they must, therefore, be narrowly construed. In any event the court did not in the Vacuum Engineering case have before it the defense that the patent in suit was invalid by reason of the patentee not being the original and first inventor, and the court therefore did not and could not decide any issue at variance with or in accord with the decision of the Court of Appeals in the case at bar.

Drewson vs. Hartje Mfg. Co.

Petitioner concedes that the decision of the Circuit Court of Appeals in the case at bar is in harmony with the decision of the Circuit Court of Appeals for the Sixth Circuit in *Drewson* v. *Hartje Mfg. Co.* (131 F. R., 734). This is correct in so far as the two cases involve the same points. Furthermore, the decision in the *Drewson* v. *Hartje* case in no wise conflicts with the decision of this court in *Bates* v. *Coe*.

The Drewson patent in suit in *Drewson* v. *Hartje* was granted August 4, 1896, upon an application filed June 12, 1895. The defense cited the Symonds patent which was granted September 3, 1895, upon an application filed January 17, 1895. The date of grant of the Symonds patent was later than the application date of the Drewson patent in suit. The application for the Drewson patent was established by a certified copy of the file-wrapper and contents.

Two arguments were made against the use of the Symonds patent as invalidating the Hartje patent: (1)

It was said that the Symonds patent "is pleaded in the answer as an anticipation, and that it was not, in fact, such a patent"; (2) It further appeared that only a printed Patent Office copy of the Symonds patent was in evidence and that the defense had not filed either a certified copy of the Symonds patent or a certified copy of the application for the Symonds patent.

As to the first point, the court said that "The omission to object to evidence of prior invention at the proper time, because not set out in the answer as required by statute, is fatal, and the objection cannot be made on appeal." In this connection the court cited authorities. From this it appears that the court ruled that the failure to make any objection to the Symonds patent because not properly pleaded made that patent available for use in connection with any defense to which it was relevant. In this respect, the case differed from *Bates* v. *Coe* where the failure to properly plead the defense relied upon resulted in that defense being ruled out. In the *Drewson* v. *Hartje* case, therefore, the Symonds invention was available for all purposes including the defense that Drewson was not the original and first inventor.

As to the second point, it was urged that the printed notation upon the printed Patent Office copy of the Symonds patent to the effect that the application had been filed January 17, 1895, was not evidence. The court granted that this notation might not be the best evidence and that the date of filing the application should be shown by a certified copy of the application itself, but the court found it unnecessary to decide this point for the reason that no objection was made to the uncertified copy of the Symonds patent on any ground whatever, and that no error was assigned because the court below

carried the date of the Symonds invention back to the date of the filing of the application. In the absence of objection or assignment of error, the court held that the date of the filing of the Symonds application was satisfactorily proven to be January 17, 1895.

Now, as to the final ruling of the court. The court made the following statement:

> "The date of the first application, in the absence of any other evidence of the date of an invention, must be taken as establishing the date of the first invention."

No exception can be taken to this ruling. Upon the defense that the grantee of the patent in suit was not the original and first inventor evidence that Symonds had made the invention at an earlier date was a good defense, and by reason of the absence of any objection to evidence of prior invention because not pleaded, the court held that such evidence was admissible. It is true that in the sentence following the one last above quoted, the court makes the statement that the Symonds patent "was, therefore, entitled to be regarded as an anticipating patent." It appears that the court did not intend this expression technically, inasmuch as the court had just ruled that the filing date of the application for the Symonds patent "must be taken as establishing the date of the first invention." The Symonds patent clearly was not an anticipating patent as it was not issued until after the filing of the application for the Hartje patent, and a reading of the court's opinion clearly shows that the decision was based upon the date of the application for the Symonds patent "as establishing the date of the first invention."

The opinion in this case when given its natural meaning is in perfect harmony with *Bates* v. *Coe*, wherein this Court merely held that upon the defense of prior patent-

ing or prior publication evidence regarding proceedings prior to the date of the grant of the patent or prior to the date of the publication was not competent. In *Bates* v. *Coe* the defense that the patentee was not the original and first inventor was not properly pleaded, as stated by the court, and was, therefore, not before the court and not discussed.

Electric Controller Co. vs. Westinghouse Electric Co.

Petitioner concedes (petition for writ of certiorari, page 23) that the decision of the Circuit Court of Appeals in the case at bar is in harmony with the decision of the Circuit Court of Appeals for the Sixth Circuit in *Electric Controller Company* v. *Westinghouse Electric Company* (171 F. R., 83). This is quite correct.

The defenses argued were anticipation and lack of patentable invention. The patent in suit was granted to Lange and Lamme April 24, 1894, upon an application filed February 25, 1893. In defense a patent to one Davis was pleaded, this patent having been granted August 15, 1893, upon an application filed January 7, 1893. The court remarked (p. 87) that if "the two applications disclosed substantially the same subject-matter, in the absence of any other evidence of the date of invention, the date of the first application would *prima facie* be taken as the date of the first invention," citing *Drewson* v. *Hartje Paper Mfg. Co.*, 131 F. R., 734, 739; 65 C. C. A., 548.

There is nothing in this opinion that is in the slightest at variance with the decision of this court in *Bates* v. *Coe*. The ruling in *Bates* v. *Coe* was merely that the date of a patent pleaded as a prior patent and the date of a publicatoin pleaded as a prior publication, could not by evidence be given any effect as of dates earlier

than the date of grant of the patent and the date of publication of the publication. In *Bates* v. *Coe* the defense that the grantee of the patent in suit was not the original and first inventor was not properly pleaded and, therefore, that defense was not passed upon. In *Electric Controller Co.* v. *Westinghouse,* the defense of anticipation was pleaded and the court said that "the date of the first application would *prima facie* be taken as the date of the first invention." This statement by the court is in strict harmony with the law as universally administered by the Patent Office since the law has been in effect, and is in harmony with the interpretation of the law by the courts generally. It happens, however, the statement of the court above quoted was not the basis of the court's decision. After analyzing the disclosure of the Davis patent, the court held that it did not show the structure claimed in the Lange & Lamme patent in suit and held that "the Davis patent may be disregarded" (171 F. R., p. 88).

Westinghouse Manufacturing Company vs. General Electric Company.

Petitioners have referred to and discussed the decision of the Circuit Court of Appeals for the Second Circuit in *Westinghouse Manufacturing Company* v. *General Electric Company,* 207 F. R,. 75, as reinforcing their contention that there is a diversity of decision between the Ninth and Second Circuits as to the effect of the filing of an application for patent. (Petition for writ of certiorari, pages 33-34.) In the Westinghouse case the court did not have before it in any shape or form any question relating directly or indirectly to the effect of the filing of a patent application upon a patent for an invention made later. The case hinged exclu-

sively upon the effect to be given to an invention made by one party in a foreign country, knowledge of which was introduced into this country before the other party filed his application for patent.

The litigation originated in an interference in the United States Patent Office between DeKando, assignor to the Westinghouse Company, and Armstrong, assignor to the General Electric Company. Priority of invention was awarded by all of the tribunals of the Patent Office and by the Court of Appeals of the District of Columbia to Armstrong.

Thereafter the Westinghouse Company, assignee of DeKando, brought suit against the General Electric Company, assignee of Armstrong, in the United States District Court for the Northern District of New York, under Section 4915 of the Revised Statutes. Following is Section 4915:

> "Sec. 4915. Whenever a patent on application is refused, either by the Commissioner of Patents or by the Supreme Court of the District of Columbia upon appeal from the Commissioner, the applicant may have remedy by bill in equity; and the court having cognizance thereof, on notice to adverse parties and other due proceedings had, may adjudge that such applicant is entitled, according to law, to receive a patent for his invention, as specified in his claim, or for any part thereof, as the facts in the case may appear. And such adjudication, if it be in favor of the right of the applicant, shall authorize the Commissioner to issue such patent on the applicant filing in the Patent Office a copy of the adjudication, and otherwise complying with the requirements of law. In all cases, where there is no opposing party, a copy of the bill shall be served on the Commissioner; and all the expenses of the proceeding shall be paid by the applicant, whether the final decision is in his favor or not." (Section 4915, Revised Statutes.)

The District Court decided that Armstrong was the prior inventor and dismissed the bill. An appeal was taken from that decree to the Circuit Court of Appeals. Following are facts as found by the District Court and adopted by the Court of Appeals.

DeKando made the invention and put it in actual use in Italy, explained and exhibited the invention to Waterman, who returned to the United States May 5, 1904, and fully explained the invention to many others, including The American Institute of Electrical Engineers, on and prior to June 19, 1905. DeKando filed his application for patent in the United States July 3, 1906.

Armstrong filed his application for patent in the United States June 28, 1905, and his patent was granted February 6, 1906. Armstrong conceived the invention prior to 1902 in the United States but made no pretense that he exercised diligence between his date of conception and the filing of his application.

The question at issue was whether the knowledge of DeKando's invention brought to the United States by Waterman before the filing of Armstrong's patent application constituted such knowledge of the invention in the United States as would operate to invalidate Armstrong's subsequently applied for and subsequently granted patent.

The Court of Appeals based its opinion upon the provisions of Sections 4886 and 4923 of the Revised Statutes, which sections are as follows:

> "Sec. 4886. Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or

more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."

"Sec. 4923. Whenever it appears that a patentee, at the time of making his application for the patent, believed himself to be the original and first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication."

The court held that—

"If Section 4886 stood alone, we might be inclined to the conclusion that upon this record Armstrong was not entitled to a patent because although, prior to his date, his art or machine had not been used here, it was known by others in this country."

In this statement the court plainly indicates that in an appropriate case it would rule that knowledge of an invention without actual use thereof would, if antecedent, invalidate a patent. But the court took the position that Section 4923 modifies and limits Section 4886 to the extent that knowledge by parties in this country of what has been done in a foreign country is exempted from the provisions of Section 4886.

It is significant that in this case the proofs show that Armstrong had a full conception of the invention prior to 1902, long before knowledge of DeKando's invention was introduced into the United States, and even before the date upon which DeKando made the invention abroad. Furthermore, the issue of the case in no way involved the question whether the filing date of a United States application is evidence that an invention was made at least as early as the date upon which the application was filed.

Petitioner cited this case as indicating a diversity of decisions between different Circuit Courts of Appeals upon the effect to be given to the filing date of a United States application for patent, but as no such question was involved the case does not have even a remote bearing upon the proposition in connection with which it was cited by Petitioner.

Unanimous Rulings of Circuit Courts of Appeals on Evidential Effect of Filing of Patent Application as Proof of Completion of Invention.

The cases above discussed are the only ones cited by Petitioners in their petition for a writ of certiorari in support of their contention that there has been a diversity of opinion upon the evidential effect of proof of the filing date of an application for patent. The cases cited by Petitioners fail to support their contention. We have examined many cases other than those cited by Petitioners, and find all of them in perfect harmony with each other and with the decision of the Circuit Court of Appeals for the Ninth Circuit in the case at bar. For convenience we present below abstracts and quotations fom the leading cases:

Webster Loom Company vs. Higgins.

(105 U. S., 580; 15 Otto, 580; 26 L. Ed., 1177, 1182.)

The opinion of the Supreme Court in this case was delivered by Mr. Justice Bradley, and for the most part deals with questions not involved in the case at bar. One of the points involved, however, was the question of the effect to be given to a patent application as evidence of the completion of an invention at a date at least as early as the date upon which the application was filed.

In this connection Mr. Justice Bradley made the following statement:

> "Webster's application for his patent was made in June, 1870. Though this was proved without objection and substantially conceded, the defendants say that it does not appear what the application was nor how much it was altered before the patent was issued. This argument cannot avail, for the application is a public record, the contents of which the defendants and all others are presumed to know; and since they had it in their power to produce it and did not, it must be presumed that it would not have served their purpose, but corresponded with the patent."
>
> (*Webster Loom Co.* v. *Higgins,* 105 U. S., 580; 15 Otto, 580; 26 L. Ed., pp. 1177, 1182.)

The decision of this Court as embodied in the passage from Mr. Justice Bradley's opinion above quoted, covers the point made by Petitioners with regard to the effect of the filing by Kirby and Schwarz of patent applications at dates long antecedent to the making of the alleged invention by Messrs. Sulman, Picard and Ballot, the grantees of the patent here in suit. As stated by Mr. Justice Bradley, the mere proof of the date of filing of the application for a patent is sufficient and carries with it the presumption that the patent application contains a description of the very same invention that is set forth in the patent. This presumption is merely the ordinary presumption that the Commissioner of Patents properly executed the law in granting the patent. In the case at bar it was not necessary for defendant to go further than to prove the filing dates of the applications for the Kirby and Schwarz patents. As a matter of fact, however, defendant introduced in evidence certified copies of the applications for these patents, but for reasons explained on pages 220-1, *supra,* did not carry them

up as a part of the Transcript upon the appeal from the District Court to the Circuit Court of Appeals.

Barnes Automatic Sprinkler Company vs. Walworth Manufacturing Company.

(60 F. R., 605.)

This case was decided by the Circuit Court of Appeals for the Seventh Circuit, Judge Woods delivering the opinion of the court. In his opinion Judge Woods made a careful analysis of the decision of this Court in *Bates* v. *Coe,* and he characterizes as an "absurdity" an attempt which was made to impose upon the ruling of this court in *Bates* v. *Coe* a meaning such as contended for by Petitioners.

The patent upon which the suit was based was granted to Charles Barnes, October 19, 1880. The defendant pleaded that Barnes unjustly obtained the patent for that which was, in fact, invented by one Charles W. Talcott, who filed his United States patent application April 8, 1879, and obtained his patent upon January 31, 1882.

Judge Woods, who handed down the opinion, discussed the decision of this court in *Bates* v. *Coe,* and inasmuch as his analysis is shorter and clearer than any we could make, we quote his opinion in full, as follows:

> "Woods, Circuit Judge, after making the foregoing statement. The opinion delivered in the Circuit Court meets our approval, and, without going into the case at large, we deem it enough to consider two objections. The fourth and fifth claims of the patent in suit were held to be anticipated by the Talcott patent of January, 1882, of which it is said in the opinion: 'The public notice of the device must be carried back to the date of filing the application,' which was in April, 1879. This, it is insisted, is in clear conflict with the following declara-

tion of the Supreme Court in *Bates* v. *Coe*, 98 U. S. 31:

" 'Neither the defendant in an action at law nor a respondent in an equity suit can be permitted to prove that the invention described in the prior patent, or the invention described in the printed publication, was made prior to the date of such patent or printed publication, for the reason that the patent or publication can only have the effect as evidence that is given to the same by the act of congress. Unlike that, the presumption in respect to the invention described in the patent in suit, if it is accompanied by the application for the same, is that it was made at the time the application was filed; and the complainant or plaintiff may, if he can, introduce proof to show that it was made at a much earlier date.'

"This rule, it is clear, can be applicable only to the one defense 'that the improvement had been patented or described in some printed publication prior to the supposed invention.' In order to come under the provision of the statute which authorizes that defense, the patent or publication relied on must be prior in point of time to the patent in suit. And it is perhaps true in respect to any form of defense that if a patent is referred to simply by number and date, without averment of earlier invention and use, or of the date of the application upon which it was granted, evidence of those particulars would not be competent, because not within the issue. But when the answer is framed, like this one, to show, not a prior patent or publication, but that the grantee of the patent in suit was not, and that the patentee of a patent of later date, issued upon an earlier application, was the first inventor, it is an anomalous proposition that the fact which the statute declares to be a defense cannot be established by any proof which, under the ordinary rules of evidence, is admissible. In the case of *Western Electric Co.* v. *Sperry Electric Co.*, 9 U. S. App. ——, 8 C. C. A. 129, 59 Fed. 295, where this court held that, when two patents for one invention had been issued, the owner of the second may sue the owner of the first, or those oper-

ating under it, without having obtained relief under Section 4918 of the Federal Revised Statutes, it is said:

"'Whether one patentee or the other, when he makes or uses the invention, is an infringer or trespasser depends upon the inquiry whether the one or the other was the first inventor, and not whether he was the first to obtain a patent; and this inquiry may as well be made in the ordinary suit in equity as in the proceeding provided by the statute.'

"If the parties in that case had been reversed, and the Western Electric Company had been made respondent to a bill by the Sperry Electric Company, either in a suit of the ordinary form in equity or under the statute, its defense would have been that its patent, though later in date, had been granted upon the earlier application to the first inventor; and yet, if the rule quoted is to have the broad application contended for, the defense could not have been admitted, and the other party would necessarily have prevailed. The decision in *Bates* v. *Coe* involves no such absurdity as that in respect to a single dispute a party may have a cause of action against his adversary, and yet, if made a respondent, have no defense. It may be granted, in the very terms of that opinion, 'that the patent or publication can only have the effect as evidence that is given the same by the statute,' and yet, when the issue of priority of invention is presented, other facts necessary or proper for the determination of that issue may be proved.

"It is further insisted that the court had no right to consider an earlier patent of Barnes as anticipating the one in suit; and reference is made to *Cantrell* v. *Wallick*, 117 U. S. 689, 694, 6 Sup. Ct. 970, for the proposition that:

"'The defendant cannot excuse or defend himself against the charge of infringement of the letters patent in suit, by saying that he infringes an earlier patent rather than the patent claimed in this case.'

"The proposition is neither to be found nor has

it support in the case cited, and the contrary is well settled. The decree of the Circuit Court is affirmed." (*Barnes Automatic Sprinkler Company* v. *Walworth Manufacturing Company,* 60 F. R., 605.)

Automatic Weighing Machine Company vs. Pneumatic Scale Corporation.

(166 F. R., 288, 293.)

This case was decided by the Circuit Court of Appeals for the First Circuit. The opinion of the court was delivered by Judge Colt, who made an exhaustive analysis of the law upon priority of invention and the evidence necessary to establish priority, referring especially to the effect of the filing of an application for patent. In view of the careful and thorough discussion of the question made by Judge Colt, we quote quite fully from his opinion as follows:

"In the present case the question of priority of invention involves two fundamental inquiries: First, is the date of a patented invention as early as the date of the application? In other words, can Thomas carry back the date of his invention to the date of his application? Second, is the date of a patented invention as early as the date of the conception? In other words, can Watson carry back the date of his invention to the date of his drawing and disclosure?

"First. With respect to the first proposition it may be said that the law is well settled that the date of a patented invention is at least as early as the date of the application, provided it sufficiently describes the invention to enable those skilled in the art to understand it; and we have found no decision in which this rule is questioned. 'Patented inventions always date at least as early as the dates of the execution of the original applications therefor, provided the original applications exhibit the inven-

tions with the above-mentioned extent of sufficiency.' Walker on Patents (4th Ed.), § 70.

"In *Kearney* v. *Railroad Company* (C. C.), 32 Fed. 320, 322, Mr. Justice Bradley said:

> " 'The relative priority of inventions is determined, first, by the dates of the respective patents therefor. But this is not conclusive. Evidence outside of the patents may be given to prove priority. The date of the application, if it describes the invention sufficiently, is conclusive evidence that the invention was made prior to such date.'

"The same rule was enforced by Mr. Justice Bradley in *National Machine Company* v. *Brown* (C. C.), 36 Fed. 317, 321. In the recent case of *Prindle* v. *Brown*, 155 Fed. 531, 534, 84 C. C. A. 45, 48, this court said:

> " 'An application of the character which we have described is of itself a positive and absolute exhibition of everything which the statute requires to constitute an invention.'

"In *Bates* v. *Coe*, 98 U. S. 31, 34, 25 L. Ed. 68, Mr. Justice Clifford, speaking for the court, said:

> " 'The presumption in respect to the invention described in the patent in suit, if it is accompanied by application for the same, is that it was made at the time the application was filed; and the complainant or plaintiff may, if he can, introduce proof to show that it was made at a much earlier date.'

"In *Barnes Automatic Sprinkler Co.* v. *Walworth Manufacturing Co.* (C. C.), 51 Fed. 88, 91, Judge Blodgett said:

> " 'I am therefore very clear that the Talcott patent of January 31, 1882, which relates back to the time it was applied for in April, 1879, clearly anticipates the fourth and fifth claims of the complainant's patent.'

"This case was affirmed on appeal, 60 Fed. 605, 9 C. C. A. 154.

"In the Barbed-Wire Patent Case, 143 U. S. 275, 12 Sup. Ct. 443, 36 L. Ed. 154, the court, in consider-

ing the evidence on the question of priority of invention, assumed that the date of the application of the patent in suit was the date of the invention; and the same assumption was made in *Miller* v. *Eagle Manufacturing Company,* 151 U. S. 186, 14 Sup. Ct. 310, 38 L. Ed. 121. See, also, *Westinghouse* v. *Chartiers Val. Gas Co.* (C. C.), 43 Fed. 582.

"The rule of the Patent Office that the filing of an allowable application is constructive reduction to practice is only the expression in another form of the rule that the application of a patented invention, if it sufficiently describes the invention, is conclusive evidence that the invention was made at least as early as that date.

"In *Lorraine* v. *Thurmond,* 51 O. G. 1781, 1782, Commissioner Mitchell, in his opinion, said, respecting this rule:

> " 'Completed and allowed applications evidence completion of invention, and in suits brought upon patents granted thereon that stage of invention which is usually evidenced by reduction to practice is conclusively assumed to have been reached. Hence the doctrine of "Constructive reduction to practice." '

"The Commissioner further said:

> " 'If, as held in *Seymour* v. *Osborne,* 11 Wall. 516, 20 L. Ed. 33, an invention is not patentable under the patent laws until it be perfected and adapted to use, and if, as held in the Telephone Cases, *supra,* and other cases cited, reduction to practice is not essential in order to obtain a patent, it follows that actual reduction to practice is not the only competent evidence of perfection and adaptation to use, but that the inventor's act in filing an allowable application is to be regarded in law as such an efficient and crowning step as to give it the standing of an invention so perfected and adapted. Interferences are declared after the applications involved are pronounced to be allowable by the experts of the Office. In determining whether the application is allowable, the question of operativeness is one of the primary considerations. (Rule 133.) It hardly need be added that

approved applications stand upon an entirely different basis from those which have been rejected by the Office or abandoned by the applicant. *Webster* v. *Sanford,* 44 O. G. 567; *Beach* v. *Fowler,* 48 O. G. 821.'

"The rule of the federal courts respecting an application which has resulted in a patent, and the rule of the Patent Office respecting an allowable application, simply mean that such applications are conclusive evidence of the completeness of the invention. In other words, they are conclusive evidence that the stage of the invention has been reached which is evidenced by reduction to practice.

"This rule of the Patent Office, as pointed out by Commissioner Mitchell in *Lorraine* v. *Thurmond, supra,* is based upon two well-established principles of the patent law:

"(1) We have, in the first place, the principle that a statutory invention (except as modified by the doctrine of 'diligence in adapting and perfecting') is a completed invention; that is, an invention which is perfected and adapted to use, or, as otherwise expressed, reduced to practice; and an inventor is not entitled to a patent—in other words, has not made an invention in the legal sense—until he has reduced his invention to practice.

"In *Agawam Company* v. *Jordan,* 7 Wall. 583, 602, 19 L. Ed. 177, the Supreme Court said:

" 'The settled rule of law is that whoever first perfects a machine is entitled to the patent and is the real inventor, although others may have previously had the idea and made some experiments toward putting it in practice. He is the inventor and is entitled to the patent who first brought the machine to perfection and made it capable of useful operation.'

"In *Seymour* v. *Osborne,* 11 Wall. 516, 552, 20 L. Ed. 33, the Supreme Court said:

" 'He is the first inventor in the sense of the patent law, and entitled to a patent for his invention, who first perfected and adapted the same to use, and it is well settled that until the invention

is so perfected and adapted to use it is not patentable under the patent laws.'

"In *Clark Thread Company* v. *Willimantic Linen Company,* 140 U. S. 481, 489, 11 Sup. Ct. 846, 849, 35 L. Ed. 521, the court, in an opinion by Mr. Justice Bradley, said, when speaking of the invention covered by the patent in suit:

" 'It is evident that the invention was not completed until the construction of the machine. A conception of the mind is not an invention until represented in some physical form, and unsuccessful experiments or projects, abandoned by the inventor, are equally destitute of that character. These propositions have been so often reiterated as to be elementary.'

"In *Woodcock* v. *Parker,* 30 Fed. Cas. 491, 492 (1813), Mr. Justice Story said:

" 'The first inventor is entitled to the benefit of his invention if he reduces it to practice and obtains a patent therefor, and a subsequent inventor cannot, by obtaining a patent therefor, oust the first inventor of his right, or maintain an action against him for the use of his own invention.'

"In *Bedford* v. *Hunt,* 3 Fed. Cas. 37 (1817), Mr. Justice Story said:

" 'the first inventor who has put the invention in practice, and he only, is entitled to the patent. Every subsequent patentee, although an original inventor, may be defeated of his patent right upon proof of such prior invention being put into use.'

"In the leading case of *Reed* v. *Cutter,* 1 Story, 590, 599, Fed. Cas. No. 11,645, Mr. Justice Story said:

" 'For he is the first inventor in the sense of the act, and entitled to a patent for his invention, who has first adapted and perfected the same to use; and, until the invention is so perfected and adapted to use, it is not patentable.'

"In *Washburn* v. *Gould,* 3 Story, 122, 133, Fed. Cas. No. 17,214, Mr. Justice Story said:

" 'The law is that whoever first perfects a ma-

chine is entitled to the patent, and is the real inventor, although others may previously have had the idea, and made some experiments towards putting it in practice. . . . He is the inventor, and is entitled to the patent, who first brought the machine to perfection, and made it capable of useful operation.'

"In *White* v. *Allen*, 2 Fish. 440, 446, Fed. Cas. No. 17,535, Mr. Justice Clifford said:

" 'In order to constitute an invention, in the sense in which that word is employed in the patent act, the party alleged to have produced it must have proceeded so far as to have reduced his idea to practice, and embodied it in some distinct form. *Gayler* v. *Wilder*, 10 How. 498, 13 L. Ed. 504; *Parkhurst* v. *Kinsman*, 1 Blatch. 494, Fed. Cas. No. 10,757; Curtis on Pat., § 43. Mere discovery of an improvement does not constitute it the subject-matter of a patent, although the ideas which it involves may be new; but the new set of ideas, in order to become patentable, must be embodied into working machinery, and adapted to practical use. *Sickles* v. *Borden*, 3 Blatch. 535, Fed. Cas. No. 12,832.'

"In *Winans* v. *New York & H. R. Co.*, Fed. Cas. No. 17,864, Mr. Justice Nelson said:

" 'It is not the person who has only produced the idea that is entitled to protection as an inventor, but the person who has embodied the idea into a practical machine and reduced it to practical use. He who has first done that is the inventor who is entitled to protection.'

"(2) At the same time we have the equally well settled rule that an invention need not be perfected and adapted to use, or reduced to practice, in order to obtain a valid patent, since no such condition is contained in the statutes.

"This question of reduction to practice arose in the case of *Wheeler* v. *Clipper Mower & Reaper Company*, 6 Fish. 1, 16 Fed. Cas. No. 17,493. In the opinion in that case Judge Woodruff said:

" 'On the argument it was insisted that the patent is void if the patentee did not reduce the in-

vention to practical use before the patent was obtained.

" 'This proposition is wholly unsound. No such condition is required by the act of Congress; and if it were true that a patent would be void on that ground, no patent could properly be granted unless proof was furnished that the invention claimed had gone into practical use, which is not, and cannot, under the statute, be made a condition of granting the patent. It is enough that the inventor has perfected his invention, and is able to furnish to the Patent Office such specifications and model as the law requires. Having done this, the patent, in so far as prerequisites to its validity, either by way of experiment or use, are material, is valid.'

"If any doubt ever existed, however, upon this point, it was conclusively settled by the Supreme Court in the Telephone Cases, 126 U. S. 1, 535, 8 Sup. Ct. 778, 782, 783, 31 L. Ed. 863. In that case, Mr. Chief Justice Waite, speaking for the court, said:

" 'But it is insisted that the claim cannot be sustained, because when the patent was issued Bell had not in fact completed his discovery. While it is conceded that he was acting on the right principle and had adopted the true theory, it is claimed that the discovery lacked that practical development which was necessary to make it practicable. In the language of counsel, there was still work to be done, and work calling for the exercise of the utmost ingenuity, and calling for the very highest degree of practical invention.

" 'It is quite true that when Bell applied for his patent he had never actually transmitted telegraphically-spoken words so that they could be distinctly heard and understood at the receiving end of his line, but in his specification he did describe accurately and with admirable clearness his process—that is to say, the exact electrical condition that must be created to accomplish his purpose; and he also described, with sufficient precision to enable one of ordinary skill in such mat-

ters to make it, a form of apparatus which, if used in the way pointed out, would produce the required effect, receive the words, and carry them to and deliver them at the appointed place. . . .

" 'The law does not require that a discoverer or inventor, in order to get a patent for a process, must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way of putting it into operation.'

"From these established and seemingly contradictory principles of the patent law, first, that an invention in order to be patentable must be reduced to practice, and, second, that, under the statutes, reduction to practice is not essential either before or after the grant of a patent, it follows that there must be some stage of an invention when it must be presumed as a matter of law that the inventor has reduced his invention to practice; and that stage is presumed to have been reached when he has done all that he is required to do to obtain a valid patent, namely, when he has filed a complete and allowable application; and hence the Patent Office has adopted the rule that the filing of such an application is constructive reduction to practice, and the federal courts have adopted the rule that such an application is conclusive evidence that the patentee made his invention—that is, reduced his invention to practice—at least as early as that date.

"The cases which hold that a rejected application is not sufficient to establish priority of invention under the statutes have no bearing on the question of the legal effect of a complete and allowable application which will result or has resulted in the granting of a patent. These cases simply enforce the rule that an invention must be perfected and adapted to use in order to prove prior invention or prior use. The Corn-Planter Patent, 23 Wall. 181, 23 L. Ed. 161; *Lyman Ventilating & Refrigerator Company* v. *Lalor;* 1 Ban. & Ard. 403, Fed. Cas. No. 8,632; *Northwestern Fire Extinguisher Company*

v. *Philadelphia Fire Extinguisher Company*, 1 Ban. & Ard. 177 Fed. Cas. No. 10,337.

"The further argument is advanced that an application is only evidence of a disclosure of a somewhat stronger character than a conception proved by drawings and disclosure. The answer to this argument is that the courts have uniformly held that an application which eventuates in a patent, and which sufficiently describes the invention, is conclusive evidence that the invention was made at the time the application was filed.

"While the defendant insists that the filing of an allowable application is not the equivalent of reduction to practice, it admits that the issue of a patent is the 'equivalent in effect in the art to reduction to practice by the completion of a machine.' We cannot see the force or reasonableness of this position. The issuance of the patent is an act of government, with which the inventor has nothing to do except to pay the final fee, while in the filing of a complete and allowable application the inventor has performed all the acts required of him under the statute for the grant of a valid patent.

"To limit a patentee who has never reduced his invention to practice, and who is not required to do so under the statutes, to fixing the earliest date of his invention as the date of his patent, is unsupported by authority, and would result in manifest injustice. For example, the Thomas patent was not issued until July 26, 1904, seven years and a half after he filed his application. If the earliest date that can be assigned for the Thomas invention is the date of his patent, any rival inventor who may have reduced his invention to actual practice during this seven and a half years, would become the prior inventor, although Thomas may have done all that the law requires to entitle him to a valid patent.

"For these reasons we must hold that the date of the Thomas invention is December 17, 1896, the date of his application."

. . . . . .

(*Automatic Weighing Machine Company* v. *Pneumatic Scale Corporation*, 166 F. R., 288, 293.) (Italics ours.)

Sundh Electric Company vs. Interborough Rapid Transit Company.

(198 F. R., 94.)

This case was decided by the Circuit Court of Appeals for the Second Circuit. The opinion of the court was delivered by Judge Lacombe. In the following passage, quoted from his opinion, Judge Lacombe carefully analyzes the different defenses that may be made in suits for infringement of patents, and shows the pertinency of proof of the date of filing of a patent application to the defense that the patentee of the patent in suit is not the original and first inventor. We quote the following from Judge Lacombe's opinion:

"(1) Among the patents introduced by defendant was one to Ihlder, No. 742,031, which, as was said by the Circuit Court, 'so closely resembles the Sundh patent in suit that the supposition arises that both Ihlder and Sundh were engaged at the same time in solving the problem and each invention performs substantially the same function.' If either of these devices were in the prior art, there would certainly be no invention in devising the other. It was held, however, that this patent was not in the prior art. Such holding was correct. The chronological sequence of events is as follows:

"June 10, 1902, Ihlder application filed.

"March 16, 1903, Sundh application filed.

"July 14, 1903, Sundh patent issued.

"October 20, 1903, Ihlder patent issued.

"No testimony carried the date of either invention back of the date of filing application. The nature of the defense of prior art is succintly expressed in Section 4920, U. S. Revised Statutes, subdivision third:

"'That it (the device of the patent) has been patented or described in some printed publication prior to his (the patentee's) invention or discov-

ery thereof, or more than two years prior to his application for a patent therefor.'

"Ihlder's device was certainly not patented before Sundh's invention, which was completed by reduction to practice on the day the latter filed his application. Nor was Ihlder's application, although it completed his invention by reducing it to practice on the day such application was filed, a 'publication' within the meaning of the statute, because it remained unpublished in the secret records of the Patent Office until after Sundh's application had been filed. The Ihlder patent, therefore, was no part of the prior art.

"It is contended, however, that the court erred in not sustaining a separate defense based upon the Ihlder patent, viz., the defense enumerated in the fourth subdivision of Section 4920, U. S. Rev. Stat. (U. S. Comp. St., 1901, p. 3395):

" 'That [the patentee] was not the original and first inventor or discoverer of any material and substantial part of the thing invented.'

"This is a separate and distinct defense from the third one, and while evidence is not admissible to carry back the date of a later patent, by showing that application for it was filed earlier, the fact that the person who took out such later patent was himself the original and first inventor of the invention in controversy earlier than the plaintiff may be proved, as any other fact is, by competent proof. *Barnes Automatic Sprinkler Company* v. *Walworth Mfg. Company*, 60 Fed. 605, 9 C. C. A. 154; *Diamond Drill Machine Company* v. *Kelly Brothers* (C. C.), 120 Fed., 295. *The various authorities cited in Judge Hazel's opinion and on the brief of appellee are concerned wholly with the other defense, prior patenting or publication.*

"(2) That Ihlder invented the device of his patent as early as June 10, 1902, the date when his application was filed, is established by the record. Invention involves two things—the mental conception and the application of that conception to the production of a practical result. So long as there is merely the mental conception and such memoranda of it as are

intelligible merely to the inventor, his invention is not complete. When, however, he actually constructs the device he has planned, either full size or in model, and the structure is found to work as expected, he has reduced the invention to practice. It is then complete. It is further settled by authority that, even though he may not build a machine or a model, he reduces his invention to practice when he files with the Patent Office an application containing specifications so careful, exact, and complete that a man skilled in the art can, by following their instructions, produce a machine which will meet the description and produce the results which the application asserts it will. *Bates* v. *Coe,* 98 U. S. 31, 25 L. Ed. 68; *Porter* v. *Louden,* 23 Wash. Law Rep. 689."

(*Sundh Electric Company* v. *Interborough Rapid Transit Company,* 198 F. R., 94, pp. 96, 97.) (Italics ours.)

Below we quote from opinions of the Circuit Courts of Appeals for the First, Fourth and Seventh Circuits, to the effect that proof of the filing of a patent application establishes that the invention set forth therein was completed at a date at least as early as the date of filing thereof.

Brooks et al. v. *Sacks,* 81 F. R., 403 (Circuit Court of Appeals, First Circuit):

"It will be noticed that Dusenbery's application was first filed; so that it is settled law that the burden was thrown on the complainant below to prove priority in behalf of his patent to the satisfaction of the court, and by evidence which shall strongly outweigh that of the respondents below, if not beyond a reasonable doubt. *Manufacturing Co.* v. *Sprague,* 123 U. S. 249, 264, 8 Sup. Ct. 122; *Clark Thread Co.* v. *Willimantic Linen Co.,* 140 U. S. 481, 492, 11 Sup. Ct. 846; Walk. Pat. (3d Ed.), 70. The inherent dangers of oral proofs in this class of cases are explained in The Barbed-Wire Patent, 143 U. S. 275, 284, 285, 12 Sup. Ct. 443, 450, and in *Deering* v.

Harvester Works, 155 U. S. 286, 300, 301, 15 Sup. Ct. 118. On an issue made directly between the two patents under Section 4918 of the Revised Statutes, or otherwise, the complainant below would be required to prove earlier invention in his behalf beyond reasonable doubt. *Morgan* v. *Daniels,* 153 U. S. 120, 14 Sup. Ct. 772. And, as shown by the cases cited, the same would be the fact if he should be sued for infringement by the holder of the Dusenbery patent. It is inconvenient, and tends to the doing of injustice and the possibility of imposing double liability, to have different rules as to the practical amount of proof required on the same issue because it happens to be presented as between different parties." (81 F. R. p. 405.)

Prindle v. *Brown et al.,* 155 F. R., 531 (Circuit Court of Appeals, First Circuit):

"It is true that there is no patentable invention in a mere mental operation, and that the general rule is that, in order to constitute a patentable invention, the mental operatoin must in some way be put into concrete form. Prof. Robinson's work on Patents (volume 1, 178) well says:

" 'No mental operation, however definite and valuable may be its result, is a complete inventive act. That which rests in thought only as a mere theory or intellectual conception can never be a means producing physical effects.'

"It is also true that the Patent Office and the courts, where no date is proven except that of the application for the patent, give the patentee the benefit of that date where his application, specifications, and claims explain what, if constructed in conformity therewith, would constitute a workable and useful machine. It is also true that it is sometimes said, as was said by the parties in this case, and also by Mr. Walker in his work on Patents (4th Ed. § 141[b]) that such an application is a 'constructive reduction to practice.' The use of such expressions in connection with an application seems to be an unnecessary paraphrase, because an application of the character which we have described is of itself a posi-

tive and absolute exhibition of everything which the statute requires to constitute an invention. It is not necessary in order to complete an invention that there be a machine constructed, or even a model." (155 F. R. p. 534.)

Ashton Valve Co. v. *Coale Muffler & Safety Valve Co.*, 52 F. R., 314 (Circuit Court of Appeals, 4th Circuit):

> "This branch of the case turns upon a simple question of law, into which no question of mechanical invention enters. The defendant's patent having been issued before that of the complainant, upon an application filed in advance of the latter's application, the burden of proof is upon the complainant to establish a prior use of the machine by a preponderance of testimony over that of defendant to the contrary." (52 F. R. p. 319.)

Consolidated Ry. Electric Lighting & Equipment Co. v. *Adams & Westlake Co.*, 161 F. R., 343 (Circuit Court of Appeals, Seventh Circuit):

> "The patent (No. 740,982) was issued October 6, 1903, on Kenndy's application, verified April 21, 1903, and filed June 5, 1903. Thus the *prima facie* case is thereby established of complete conception by the patentee as of the date of his application (Robinson on Patents, §§ 132, 372, 380, 1024; Walker on Patents, §§ 69, 70, 510); and the right of the patentee is well recognized to carry the date back to the actual inventive act, as against rival claimants. (1 Robinson on Patents, §132.)" (161 F. R., 343, p. 349.)

Conclusion.

We submit that the grounds for grant of the writ of certiorari and for reversal of the Circuit Court of Appeals set forth by Petitioners in their petition for the writ (Petition for writ of certiorari, pages 3 and 4) are devoid of merit and contrary to fact for the following reasons:

1. That there is no conflict, suggestion or possibility of conflict between the decree of the Court of Appeals and the judgments of the House of Lords and the Privy Council.

2. That there is no conflict upon any question of law between the decision of the Circuit Court of Appeals and this Court upon the effect to be given to the use of alleged inventions; that the Court of Appeals based its decision upon the law as established by this Court (Transcript, pages 721, 722); and furthermore, that there is no evidence that the alleged invention of the patent in suit has ever been used in the United States.

3. That there is no conflict of decisions or even of dicta between the courts of the different circuits, or between the Circuit Courts of Appeal and this Court, upon the anticipatory effect of an invention patented subsequent to the origin of the alleged invention covered by a patent in suit but upon an application filed in the Patent Office prior thereto.

We submit that the decree of the Circuit Court of Appeals should be affirmed on each of the following grounds.

That the patent in suit is anticipated and invalid; that all of the claims of the patent of which infringement is charged, namely, claims 1, 2, 3, 5, 6, 7, 9, 10, 11, and 12 are anticipated by each of the following processes—Everson, Froment, Schwarz, Glogner, and Kirby; and that those claims which do not specify the use of acid, namely, claims 1, 5, 9, 10, and 12, are anticipated by the Haynes British patent.

That under the provisions of the first clause of Section 4920 of the Revised Statutes the patent in suit is invalid by reason of the fact that for the purpose of deceiving the public the specification of said patent was made to contain more than the whole truth relative to

the alleged invention, in that the representation is made, contrary to fact, that it is necessary that less than 1 per cent. of oil be used.

That the patent in suit is invalid for the reason that according to the testimony of the patentees they had no part in making the alleged invention, but that said alleged invention was originated by Arthur H. Higgins; that the instructions given by the patentees to Higgins were confined to an investigation of the Cattermole sinking granule process; that the alleged invention of the flotation process was outside of the instructions given to Higgins, was not a carrying out of any idea communicated by the patentees to Higgins and was the independent act of Higgins.

That infringement of the patent in suit has not been proved for the reason that the record contains no evidence that respondent used less than 1 per cent. of oil relative to ore in the concentration operations upon which the charge of infringement rests.

October 2, 1916.

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Counsel for Respondent.

October, 1916.

In the

Supreme Court of the United States.

October Term, 1916.

Minerals Separation, Limited, and Minerals Separation American Syndicate, Limited, Petitioners,
vs.
James M. Hyde, Respondent.
} No. 46.

Respondent's Reply Brief.

I.

This brief in reply to Petitioners' reply brief is filed in accordance with leave granted by the Court during the argument of the case.

Petitioners state, upon page 32 of their reply brief, that their proposition that "a new principle of action is involved in the process in issue finds confirmation also in the fact that . . every other oil process that is cited by Respondent, as substantially identical with and as anticipating the process in suit, failed in the mill, if ever tried there. . . ."

In support of this statement Petitioners allege that there is affirmative evidence to the effect that opera-

tions with larger quantities of oil than named in the patent in suit could not be successfully operated "in the mill"—that is, upon a practical and commercial scale. In connection with this allegation Petitioners refer in their reply brief (Reply Brief, page 9) to pages 196 to 200 of their principal brief. The passage in their principal brief referred to is a description of certain experimental operations performed by their witnesses and employees, Messrs. Chapman and Higgins.

Had not the Higgins and Chapman experiments been urged so strongly in Petitioners' reply brief as evidence of the inutility of practical commercial operations with more than the amount of oil indicated in the patent in suit these experiments would not have been discussed by Respondent for the reason that the operations of these witnesses were in themselves not on a large scale, not practical or commercial or in any sense an approach to actual milling conditions, but on the contrary were admittedly simply laboratory tests.

Mr. Higgins is and has been for many years an employee of Minerals Separation, Limited (Transcript, page 174). He was first examined under a commission as a witness for Respondent. Later he testified as a witness for Petitioners and in so testifying described the experiment which is relied on by Petitioners as affirmative proof that operations with more than one per cent. of oil are impracticable upon a large scale. As to this experiment Petitioners correctly state (last paragraph of page 198 of Petitioners' principal brief) that the tests made by Mr. Higgins were conducted "in a continuous testing plant of miniature size used

for testing purposes, and having a maximum capacity of seven tons per day." Mr. Higgins describes this operation in the part of his testimony appearing on page 387 of the transcript. He states that the machine used was "nominally a five ton plant", although having a maximum capacity of seven tons per day, and "not intended for commercial use in treating zinc ores, being only a testing plant."

The other witness upon whom reliance is placed by Petitioners for their statement that operations with quantities of oil greater than one per cent. are impractical upon a large scale is Mr. Chapman. Mr. Chapman is an employee of Minerals Separation, Limited (Transcript, page 181). His testimony regarding the alleged operations upon a large scale appears in the transcript at pages 388 to 392. Mr. Chapman states that the plant used by him "is known as a 50-ton plant and could be worked at that capacity at a mine, but it is used for testing purposes only and never run to its full capacity." (Transcript, page 388, near bottom of page.) Mr. Chapman states that in each of his four tests he used 1680 pounds of ore, and that this amount of ore was supplied to the machine during a period of one hour. The capacity of the machine, 50 tons per day, is equivalent to a capacity of 4,166 pounds per hour, thus showing that Mr. Chapman supplied to the machine ore to the extent of about 40 per cent. of its capacity. Each of the four test operations performed by Mr. Chapman continued for only one hour, and, as stated by him, the tests were conducted in a machine used for testing purposes only, as distinguished from actual mill operations at a mine.

In its final analysis the proposition advanced by Petitioners that this record contains affirmative proof that

operations with more than one per cent. of oil cannot be conducted upon a practical basis, rests upon Mr. Higgins' test conducted in what he himself states was a machine "not intended for commercial use", and what Petitioners themselves characterize in their brief as "a continuous testing plant of miniature size" (Petitioners' principal brief, page 198, last paragraph); and upon four brief operations conducted by Mr. Chapman in an apparatus which he stated was "used for testing purposes only", and in each of which experiments the apparatus was operated for only one hour, during which time less than one ton of ore was treated.

Mr. Higgins says nothing as to the amount of ore treated by him, stating only that he supplied the ore at the rate of ten pounds per minute. The record is silent as to the time the operation continued. The only indication regarding the duration of Mr. Higgins' experiment is contained in his statement that "in about three minutes the plant had settled into a permanent condition." (Transcript, page 387.) He then describes the float as being copious, "and though oily in appearance when closely examined, did not differ in appearance from the usual agitation froth at a distance of a few feet." (Transcript, page 387.)

This operation, conducted by Mr. Higgins, was carried out with the amount of oil used in the experiment performed by Respondent's expert witness, Dr. Byrnes, namely, 3.6 per cent. relative to the ore by weight (Transcript, page 387); and the experiment purports to be a repetition of Dr. Byrnes' operation. But there is nothing in Mr. Higgins' testimony to indicate that the degree or duration of agitation im-

parted to the pulp in his experiment either was or was not the same, or approximately the same, as that employed by Dr. Byrnes. For all that appears from the record Mr. Higgins' demonstration may have varied in many ways from the operation performed by Dr. Byrnes and may have varied in such ways as to make a more efficient result than obtained by Mr. Higgins impossible

Dr. Byrnes' description of his demonstration with 3.6 per cent. of cotton seed oil appears in the paragraph beginning at the sixth line of page 108 of the transcript and, as there stated, he obtained 211 grams of concentrate having a zinc content of 48.3 per cent., and the tailings weighed 292 grams and contained only one per cent. of zinc. As stated by Dr. Byrnes, he recovered the concentrate in the form of a froth. Mr. Higgins obtained a concentrate containing 47.54 per cent. zinc (Transcript, page 387); that is, a concentrate of approximately the same purity as that obtained by Dr. Byrnes, but as stated by Mr. Higgins, the tailings or reject resulting from his operation contained 12.94 per cent. zinc. The fact that the result obtained by Mr. Higgins was not as efficient as that obtained by Dr. Byrnes affords no basis for inference in the absence of any statement by Mr. Higgins as to whether all the conditions employed by him were or were not the same, or approximately the same, as employed by Dr. Byrnes. Furthermore, whatever Mr. Higgins' demonstration showed, it shows nothing relative to what can be effected upon a large scale and commercially, for the simple reason that the experiment was conducted in a plant having a daily capacity of only five to seven tons, which, as properly stated

in Petitioners' brief (Petitioners' principal brief, page 198), was "of miniature size".

The sum total of the alleged affirmative evidence that quantities of oil larger than one per cent. cannot be used commercially is the treatment of some small and unnamed amount of ore in a miniature apparatus, and four experimental operations in each of which less than a ton of ore was treated.

Mr. Chapman's testimony regarding his experiments, like Mr. Higgins' testimony, is absolutely lacking in any statement or indication that either the duration or degree of agitation imparted to the pulp was the same as or in any way similar to that employed by Dr. Byrnes in his experiment described upon page 108 of the transcript, of which Mr. Chapman's operations purport to be a repetition. The only reference to the amount of agitation appears in the last paragraph of page 390 of the transcript, where Mr. Chapman states that it was suggested to him by their patent agent that he would "more nearly parallel Dr. Byrnes' tests by having less agitation". Mr. Chapman then states that he thereupon made some change in his manipulation "using only six agitators", whereupon "the results were a slight improvement." There is nothing in the testimony to indicate that even after this change in manipulation the agitation was the same or even similar to that employed by Dr. Byrnes, but the testimony is that his effort to more nearly duplicate Dr. Byrnes' operation did result in an improvement.

Higgins and Chapman are both interested witnesses. Both of them are employees of Petitioners. Their experiments were admittedly conducted in miniature or merely testing apparatus. There is an absolute failure

of evidence that their procedure duplicated, or even approximately duplicated, Dr. Byrnes' experiment. They do not even state that they made any attempt to reproduce all of the conditions employed by Dr. Byrnes.

Nutter, however, testified that all of these factors are of vital importance (Respondent's principal brief, pages 63 to 67). The necessity of adapting the character of the agitation to the amount of oil is clearly set forth by Mr. Sulman, one of the grantees of the patent in suit. Upon this subject he made the following statement:

> "With decreasing proportions of oil more vigorous agitation or mixing is necessary to ensure such efficient contact of oil with the mineral particles. The agitation may therefore be said to be roughly proportioned to the work to be done in bringing about contact between large or small quantities of oil in regard to the mineral." (Transcript, page 129.)

The fact stated by Mr. Sulman in the foregoing quotation is also stated in effect by Respondent's witness, Mr. Gibson, who stated (Transcript, page 75) that he was told that in the operation of the Basin experimental plant the use of too much oil would be indicated by a flat film and sinking globules. This was merely another way of stating that if the amount of oil were altered without changing the agitation correspondingly the result would be impaired.

Higgins and Chapman merely say that they used the same proportion of oil. Failure can be brought about with any proportion of oil, whether greater or less than one per cent., and the testimony of these wit-

nesses shows nothing other than that, by some means not described by them, they caused some small scale experiments to produce an inefficient though not unsuccessful result. Such operations in the hands of these witnesses who, in the interest of their employer, desired to bring about failure, have no evidential weight whatever. Furthermore the efforts of these witnesses did not result in failure, but merely in more or less imperfect results, and Higgins admits that he obtained the froth which is said to be characteristic of the patent in suit.

II.

Petitioners in their reply brief also make the following statement:

> "It is in the highest degree significant that the Respondent, instead of demonstrating the practicability in the mill of a process of ore concentration involving the use of notable quantities of oil, as it could perfectly well have done, if any practical process of that kind existed or were possible, contented itself with the legerdemain of the laboratory, wholly inconsequential even at best in its implication. . . ." (Petitioners' reply brief, page 9.)

In this connection it is significant that practically all of the expert evidence introduced by Petitioners is based upon operations conducted in experimental apparatus, namely, the so-called slide machine. That there is no material deviation in results obtained by the use of the slide machine and the use of large scale and commercial apparatus is repeatedly stated by Peti-

tioners' witnesses. We quote from their testimony as follows:

> "In my experience with the agitation froth process I have found on every occasion that has come under my own personal observation that the results of tests in the slide machine were always improved in the actual working of commercial plants. The improvements were not only those of recovery, but in the consumption of reagents." (Chapman, Transcript, page 195, paragraph beginning at line 15 from the bottom of the page.)

> "Q. 44. Would you make a distinction as to the mode of operation upon a commercial scale?
> "A. On a commercial scale, or before commercial operations are begun, small scale work should, and would invariably, be carried out to determine the best quantities, and the oil supply fed to a commercial plant would be calibrated accordingly, that is, after ascertaining the quantity of ore plus water fed into the plant, the oil feeding apparatus would be set to deliver as nearly as possible the quantities per ton determined by small scale experiments." (Ballot, Q. 44, page 162.)

> "Q. 66. Did the small scale apparatus and the larger scale plant referred to in your answer to Q. 62 operate in substantially the same way?
> "A. Substantially, yes, the same characteristic froth was produced, but the chief difference consisted in the one being a continuous plant and the other intermittent." (Ballot, Q. 66, page 164.)

Petitioners are in the position of indorsing small test machines as affording reliable indications of what can be done in large scale practical operations, and throughout the prosecution of this case Petitioners'

witnesses have used small test apparatus as affording evidence of the points they desire to urge upon the attention of the Court. It is only in those instances where the results are unfavorable to Petitioners' contentions that the use of small scale machines is condemned by them.

III.

That the flotation process can be successfully practiced with larger quantities of oil than claimed in the patent in suit is shown by the testimony of Respondent's expert witness, Dr. Byrnes. The alleged infringing act was the operation of an experimental machine built by Respondent for the Butte and Superior Copper Company (Transcript, page 82). Mr. Nutter, Petitioners' chief engineer took a sample of concentrate from the experimental plant (Transcript, page 41), and Dr. Chandler, expert witness for Petitioner, estimated from an examination of this sample that Respondent was using 3.2 pounds of oleic acid per ton of ore (Transcript, page 60, last line of page). The experimental machine built by Mr. Hyde was used only for about two months succeeding August 1, 1911, and was then replaced by another machine (Transcript, page 95). Dr. Byrnes, as stated by him, (Transcript, bottom of page 115, and succeeding pages), "performed experiments with the full-size flotation plant at the Basin, Montana, mill." He describes one of his experiments as follows:

> "I then opened the valve in the oil-discharge pipe to its full capacity, allowing about seven times the normal feed of oil to flow, also separately

adding to the agitator a few per cent., proportionate to the cotton-seed oil, of 'red oil', warmed to make it liquid. I then obtained very good heavy froths and very clean tailings, as good, I think, as I saw produced at any time when I was at the mill. It is thus apparent that different oils can be used, in widely different proportions, as I also found in my tests with the Hyde slide apparatus." (Transcript, page 118, lower part of the page.)

Assuming for the purpose of argument, though not admitting as a fact, that in the operations conducted at Basin, Montana, Respondent used the small amount of oil estimated by Dr. Chandler, 3.2 pounds per ton of ore (Transcript, lower part of page 60), Dr. Byrnes in increasing the oil supply to seven times the usual amount brought the oil consumption to seven times 3.2 pounds, or 22.4 pounds, per ton of ore, which amounts to 1.12% of oil relative to ore by weight. This amount is greater than the maximum amount suggested in the patent in suit, namely, a "fraction of one per cent. Furthermore, counsel for Petitioners admitted in argument that the use of any amount of oil greater than one-half of one per cent. would not be an infringement of the patent, and the amount used by Dr. Byrnes in the full-size plant, 1.12%, would, upon the assumption stated above, be over twice the maximum quantity that according to the admission of Petitioners' counsel would constitute infringement. And with this amount of oil used in a full-size plant Dr. Byrnes found the results as good as with smaller quantities.

IV.

Petitioners at pages 17 and 18 of their reply brief discuss the Everson process as set forth in the Everson patent and in the Fryer Hill and the Criley-Everson Publications. In this connection it is interesting to observe the discrepancy between Petitioners' attitude in the suit at bar and the position assumed by Petitioners' licensee. This discrepancy appears from a consideration of the testimony upon which the judgment of the Privy Council was based. Ordinarily we should not refer to this testimony, but upon pages 3 to 5 of their reply brief Petitioners quote from the testimony of Professor Pollock, one of the witnesses in the suit which was finally adjudicated by the Privy Council. This quotation is made for the purpose of creating the impression that Respondent has attached an erroneous meaning to a quotation from the judgment of the Privy Council appearing in Respondent's principal brief. We fail to see how the quotation from Professor Pollock's testimony in any way modifies the meaning properly to be attached to our quotation from the judgment of the Privy Council. We further fail to perceive the propriety of the introduction by Petitioners of this quotation from Professor Pollock's testimony in their reply brief. Inasmuch as the testimony in the Privy Council case is neither in evidence nor even in the physical possession of the Court, the quotation appears to be unavailable for consideration in this suit. However, as the quotation in question has been introduced by Petitioners in their reply brief, we present for what it may be worth the following testimony in the Privy

Council case regarding the attitude of the licensee of Minerals Separation, Limited, the Sulphide Corporation, toward the Everson process.

In the suit at bar Petitioners and their witnesses have contended that the process described in the Everson patent does not result in the production of a floating froth or scum, and therefore does not anticipate the patent in suit. Petitioners have even gone to the extent of exhibiting to the court a batea, or gold miner's pan, which is not in evidence in this case, and regarding which no evidence was introduced in this case; and have represented to the Court that the Everson process is merely a panning process of the type practiced by gold miners. The only appearance of this theory and this exhibit batea previously was its introduction in evidence in the suit of Minerals Separation, Limited, against the Miami Copper Company in the United States District Court for the District of Delaware, from which court the exhibit was withdrawn for exhibition here.

In the Privy Council case Mr. Bertram Blount, expert witness for the Sulphide Corporation, a licensee of Petitioner, testified, as quoted below, regarding the process set forth in the Criley and Everson Publication, which appears at page 415 of the transcript in the suit at bar. This testimony is quite significant in view of the fact that the Criley and Everson Publication and the claims of the Everson patent were the only evidence before the Privy Council regarding the Everson process, the specification of the Everson patent and the Fryer Hill publication not being in evidence. Following is Mr. Blount's testimony:

"3204 Q. Now, I want to know if you made a number of experiments on that Criley and Everson? A. Yes.

"3205 Q. I would like you to give me the details of those experiments, and the results obtained by you? A. Here is one I made here in this city within the last few days; I took fifty grammes of South Mine tailings, that is a Broken Hill ore, and I mixed that with two cubic centimeters of dark summer oil, that being a thick black oil, mixed that into a stiff paste and added 200 centimeters of water containing one per cent. of sulphuric acid by weight and heated nearly to boiling.

"3206 Q. What did you do with it? A. I took it and mixed it in a beaker or basin, whatever was convenient—it does not matter what the vessel is so long as it will hold the mixture. The metal rose as a froth to the surface; you stir it and mix it, and the metals rise as froth and can be skimmed off.

"3207 Q. What becomes of the gangue? A. The gangue remains at the bottom almost clean. In this particular ore the gangue happens to be a very white one, and it is very striking to the eye to see the original black ore converted into an almost perfectly white residuum, and the thick scum of the sulphurets at the top of the water.

"3208 Q. As regards the amount of agitation you gave it, is it necessary to give it much agitation? A. Oh, no, you stir it with a glass rod just as you make an ordinary mixture in the laboratory, and the scum rises up at once."

In addition to the fact that there is no conflict between the Privy Council judgment and the decree of the Circuit Court of Appeals in the suit at bar, the foregoing quotation is additional proof of the fact that

the Privy Council judgment was based on evidence diametrically contradictory of the evidence introduced by Petitioners in the suit at bar.

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